Neuroscience: The Biological Perspective

Chapter 2

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Chapter 2 Learning Objective Menu

- LO 2.1 How parts of nervous system relate
- LO 2.2 Neurons and nerves and how they work
- LO 2.3 How neurons communicate
- LO 2.4 Neurotransmitters
- LO 2.5 How brain and spinal cord interact
- LO 2.6 Somatic nervous system; interacting with surroundings
- LO 2.7 Autonomic nervous system and reaction to stress
- LO 2.8 Study of the brain and how it works
- LO 2.9 Structures and functions of the bottom part of the brain
- LO 2.10 Structures that control emotion, learning, memory, motivation
- LO 2.11 Parts of cortex controlling senses and movement
- LO 2.12 Parts of cortex responsible for higher forms of thought
- LO 2.13 Differences between left side and right side of the brain
- LO 2.14 Hormones interact with nervous system and affect behavior

Overview of Nervous System

- Nervous System - an extensive network of specialized cells that carry information to and from all parts of the body.
- Neuroscience – deals with the structure and function of neurons, nerves, and nervous tissue.
  - Relationship to behavior and learning.

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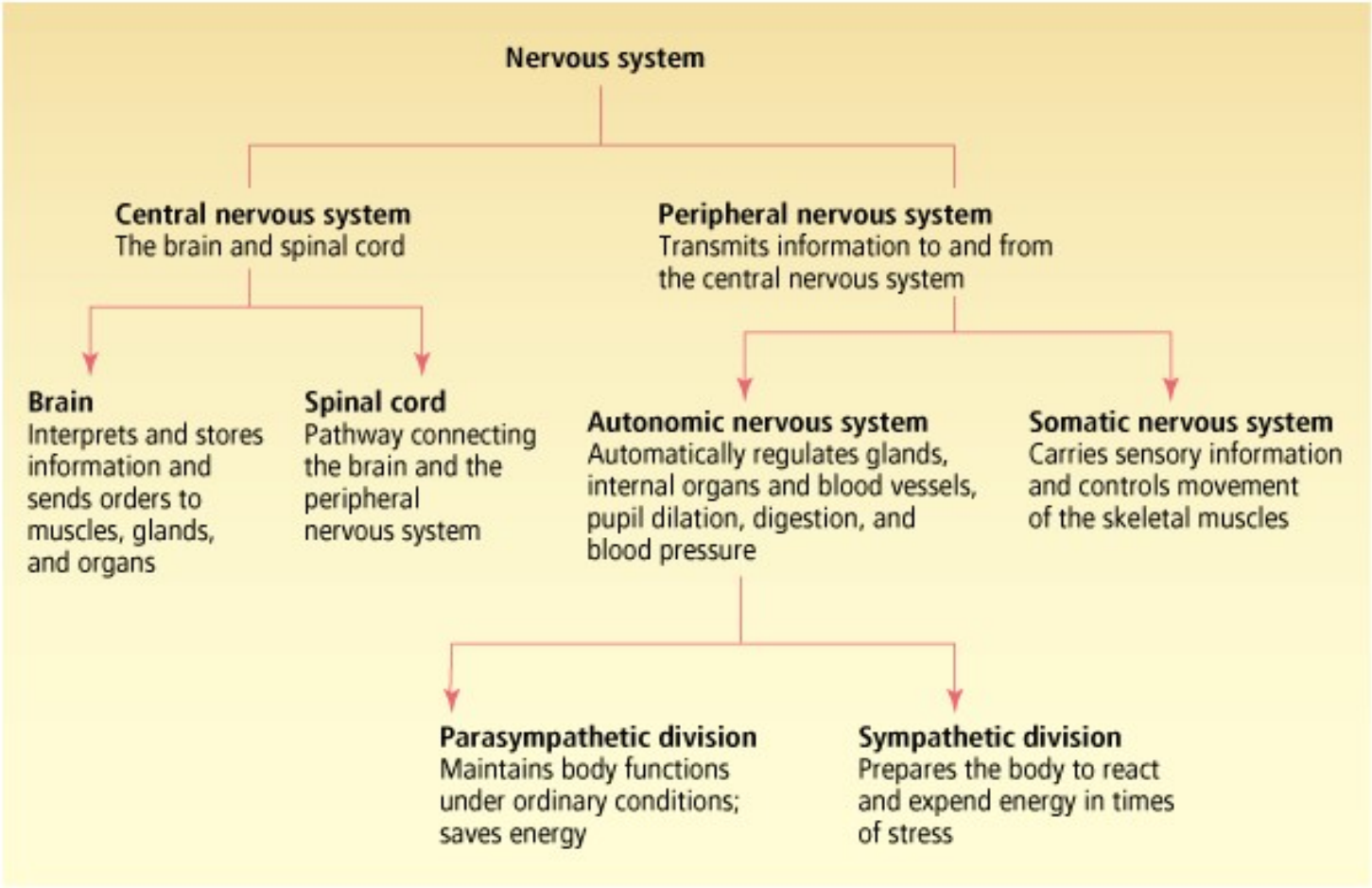
FIGURE 2.1 **An Overview of the Nervous System**

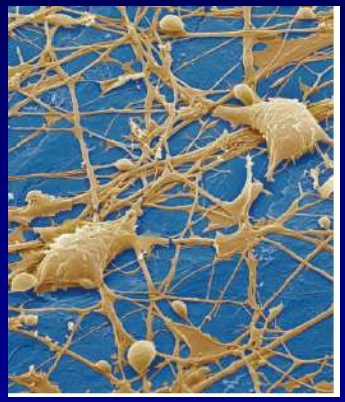
LO 2.1 Parts of nervous system


Nervous system
Central nervous system
The brain and spinal cord
Peripheral nervous system
Transmits information to and from the central nervous system
Brain
Interprets and stores information and sends orders to muscles, glands, and organs
Spinal cord
Pathway connecting the brain and the peripheral nervous system
Autonomic nervous system
Automatically regulates glands, internal organs and blood vessels, pupil dilation, digestion, and blood pressure
Somatic nervous system
Carries sensory information and controls movement of the skeletal muscles
Parasympathetic division
Maintains body functions under ordinary conditions; saves energy
Sympathetic division
Prepares the body to react and expend energy in times of stress

Menu

Structure of the Neuron

- Neurons - the basic cell that makes up the nervous system and which receives and sends messages within that system.
- Parts of a Neuron
  - Dendrites - branch-like structures that receive messages from other neurons.
  - Soma - the cell body of the neuron, responsible for maintaining the life of the cell.
  - Axon - long tube-like structure that carries the neural message to other cells.



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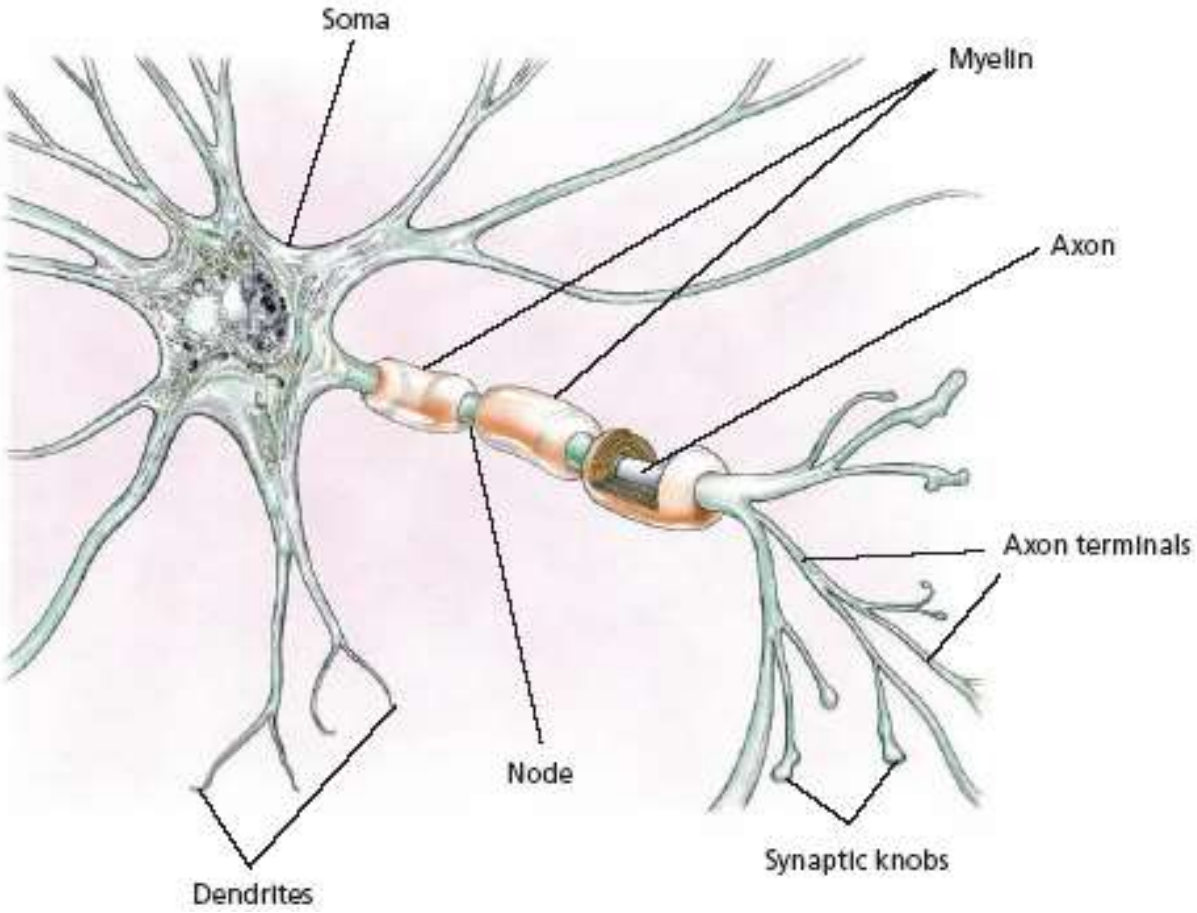
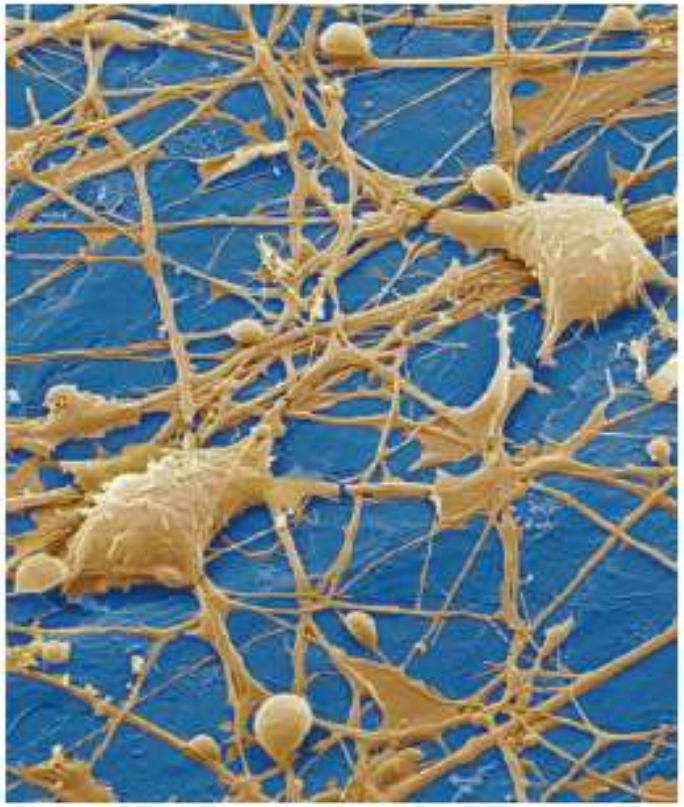
LO 2.2 Neurons and nerves

FIGURE 2.2 **The Structure of the Neuron** The electron micrograph on the right shows neurons with axons and dendrites extending from them.





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Other Types of Brain Cells

- Glial cells - grey fatty cells that:
  - provide support for the neurons to grow on and around,
  - deliver nutrients to neurons,
  - produce myelin to coat axons,
    - Myelin - fatty substances produced by certain glial cells that coat the axons of neurons to insulate, protect, and speed up the neural impulse.
  - clean up waste products and dead neurons.

Menu

Neurons in the Body

- Nerves – bundles of axons in the body that travel together through the body.
  - Neurilemma – Schwann's membrane.
    - Tunnel through which damaged nerve fibers can repair themselves.

Menu

Generating the Message: Neural Impulse

- Ions – charged particles.
  - Inside neuron – negatively charged.
  - Outside neuron – positively charged.
- Resting potential - the state of the neuron when not firing a neural impulse.
- Action potential - the release of the neural impulse consisting of a reversal of the electrical charge within the axon.
  - Allows positive sodium ions to enter the cell.
- All-or-none - referring to the fact that a neuron either fires completely or does not fire at all.
- Return to resting potential.

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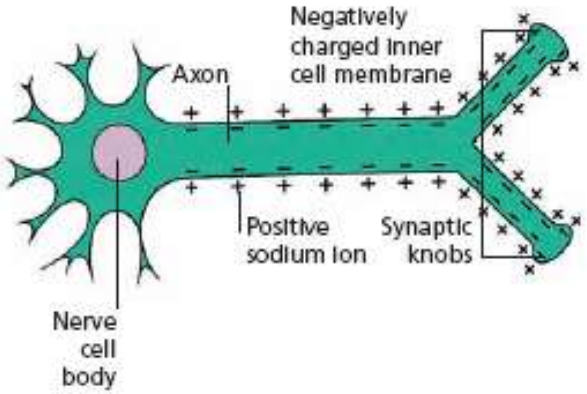
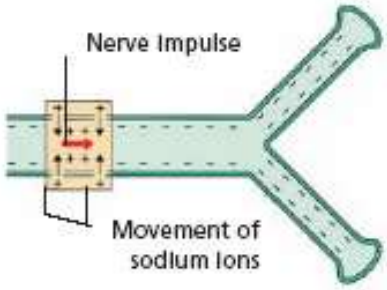
LO 2.2 Neurons and nerves

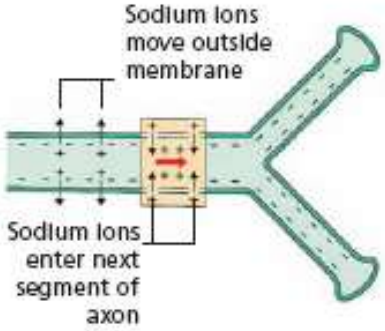
FIGURE 2.3 **The Neural Impulse Action Potential** In the graph below, voltage readings are shown at a given place on the neuron over a period of 20 or 30 milliseconds (thousandths of a second). At first the cell is resting; it then reaches threshold and an action potential is triggered. After a brief refractory period, the cell returns to its resting potential.



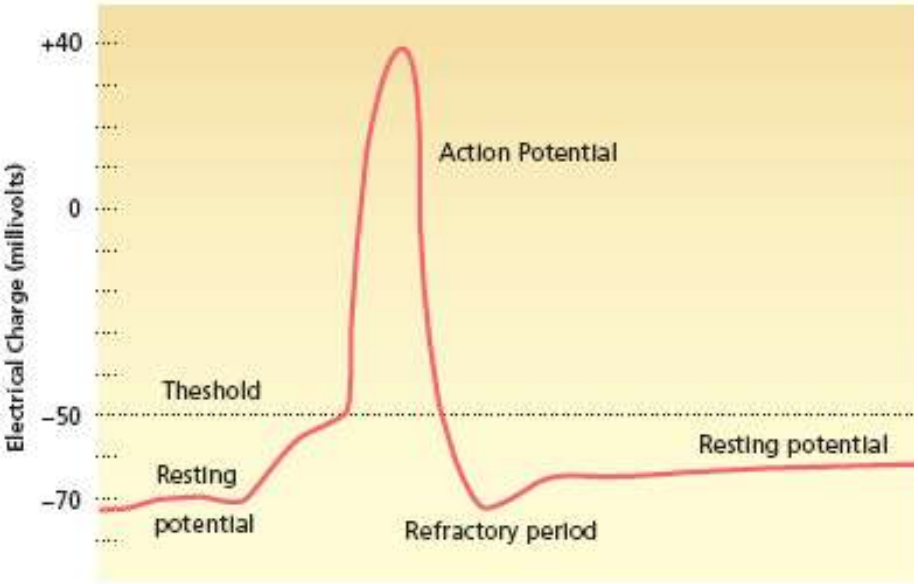
The Neuron at Rest
During the resting potential the neuron is negatively charged inside and positively charged outside.



The Neural Impulse
The action potential occurs when positive sodium ions enter into the cell, causing a reversal of the electrical charge from negative to positive.



The Neural Impulse Continues
As the action potential moves down the axon toward the axon terminals, the cell areas behind the action potential return to their resting state of a negative charge as the positive sodium ions are pumped to the outside of the cell.



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Sending the Message to Other Cells

- Axon terminals - branches at the end of the axon.
  - Synaptic knob – rounded areas on the end of axon terminals.

Synaptic vesicles - sack-like structures found inside the synaptic knob containing chemicals.

- Neurotransmitters - chemical found in the synaptic vesicles which, when released, has an effect on the next cell.

- Synapse/synaptic gap - microscopic fluid-filled space between the rounded areas on the end of the axon terminals of one cell and the dendrites or surface of the next cell.
- Receptor sites - holes in the surface of the dendrites or certain cells of the muscles and glands, which are shaped to fit only certain neurotransmitters.

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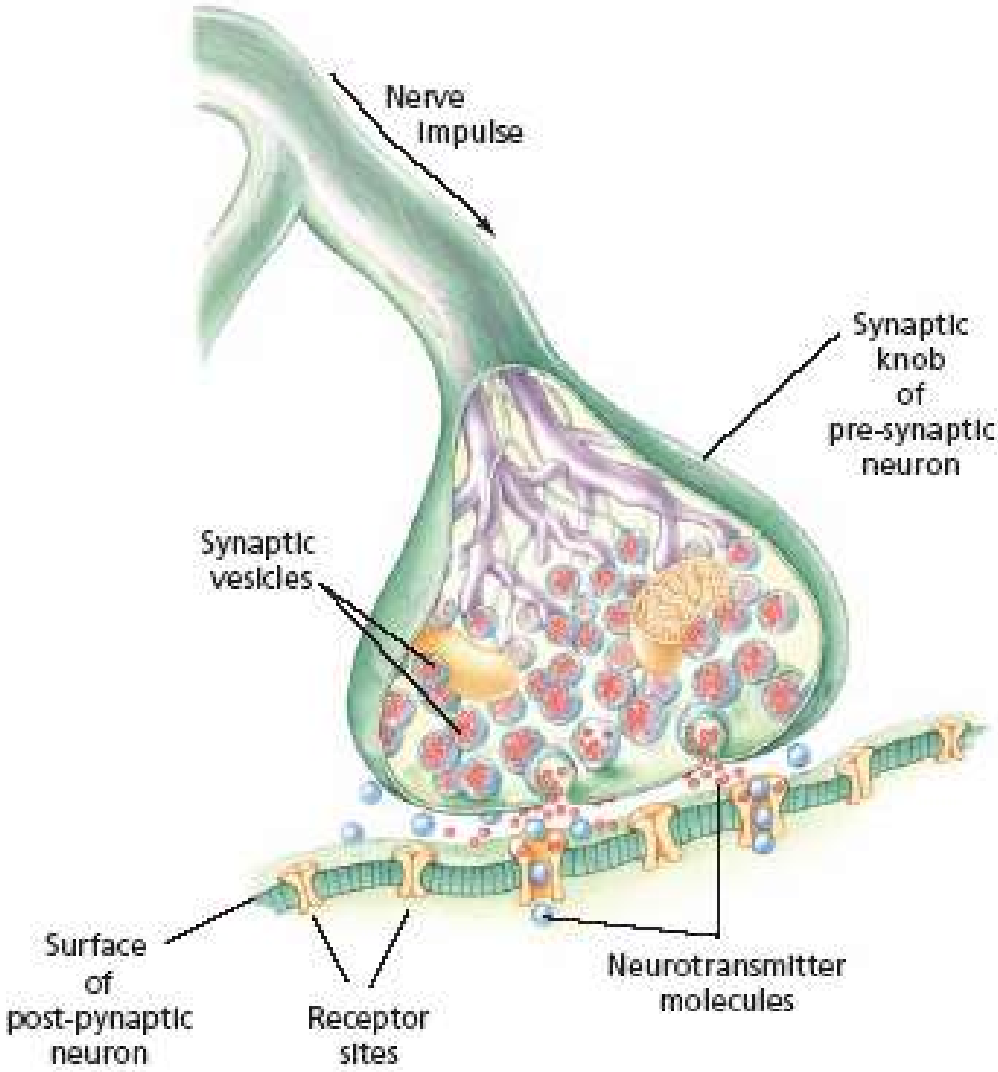
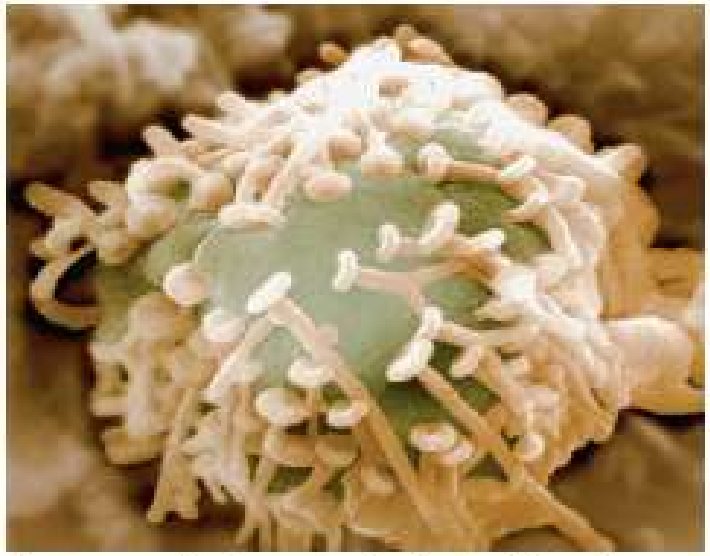
LO 2.3 Neuron communication

FIGURE 2.4 **The Synapse** The nerve impulse reaches the synaptic knobs, triggering the release of neurotransmitters from the synaptic vesicles. The molecules of neurotransmitter cross the synaptic gap to fit into the receptor sites that fit the shape of the molecule.





A micrograph of synaptic knobs (small mushroom-like fibers) clustering around another neuron's cell body.

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Neuron Communication

- Neurons must be turned ON and OFF.
  - Excitatory neurotransmitter - neurotransmitter that causes the receiving cell to fire.
  - Inhibitory neurotransmitter - neurotransmitter that causes the receiving cell to stop firing.
- Chemical substances can affect neuronal communication.
  - Agonists - mimic or enhance the effects of a neurotransmitter on the receptor sites of the next cell, increasing or decreasing the activity of that cell.
  - Antagonists - block or reduce a cell's response to the action of other chemicals or neurotransmitters.

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Neurotransmitters

- Types of neurotransmitters

TABLE 2.1 NEUROTRANSMITTERS AND THEIR FUNCTIONS

Neurotransmitters	Functions
Acetylcholine	Involved in memory and stimulates movement.
Serotonin	Involved in mood, sleep, and appetite.
GABA (Gamma-aminobutyric acid)	Involved in sleep and inhibits movement.
Glutamate	Involved in memory formation.
Norepinephrine	Involved in arousal and mood.
Dopamine	Involved in control of movement and sensations of pleasure.
Endorphins	Involved in pain relief.

Menu

Cleaning up the Synapse

- Reuptake - process by which neurotransmitters are taken back into the synaptic vesicles.
- Enzyme - a complex protein that is manufactured by cells.
  - One type specifically breaks up acetylcholine because muscle activity needs to happen rapidly, so reuptake would be too slow.

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Central Nervous System

- Central nervous system (CNS) - part of the nervous system consisting of the brain and spinal cord.
  - Spinal cord - a long bundle of neurons that carries messages to and from the body to the brain that is responsible for very fast, lifesaving reflexes.

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The Reflex Arc: Three Types of Neurons

- Sensory neuron - a neuron that carries information from the senses to the central nervous system.
  - Also called afferent neuron.
- Motor neuron - a neuron that carries messages from the central nervous system to the muscles of the body.
  - Also called efferent neuron.
- Interneuron - a neuron found in the center of the spinal cord that receives information from the sensory neurons and sends commands to the muscles through the motor neurons.
  - Interneurons also make up the bulk of the neurons in the brain.

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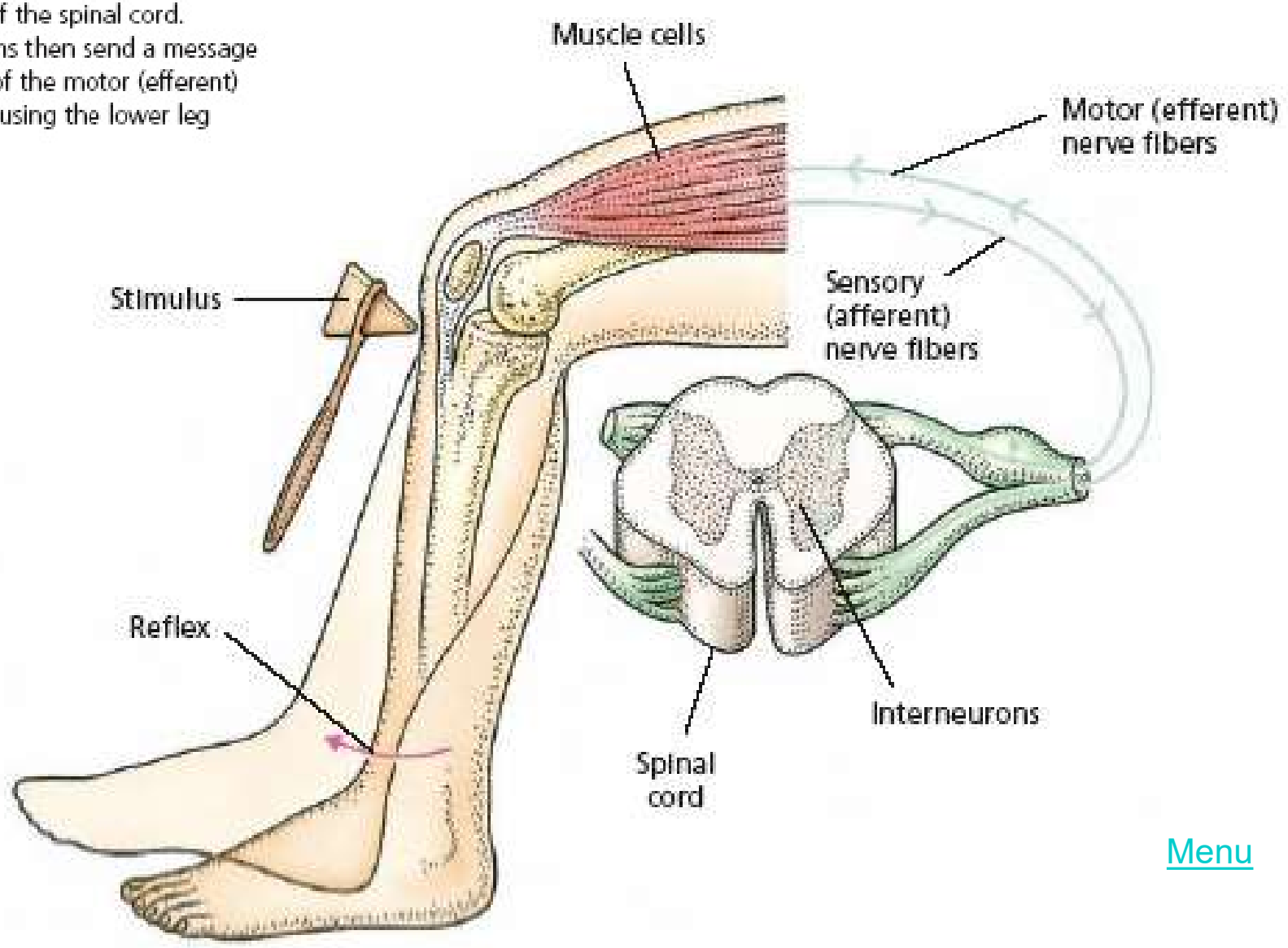
FIGURE 2.5 **The Spinal Cord Reflex**
The hammer tap just below the kneecap stimulates the sensory (afferent) nerve fibers, which carry the message up to the interneurons in the middle of the spinal cord. The interneurons then send a message out by means of the motor (efferent) nerve fibers, causing the lower leg to jerk.



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Peripheral Nervous System

- Peripheral nervous system (PNS) - all nerves and neurons that are not contained in the brain and spinal cord but that run through the body itself; divided into the:
  - Somatic nervous system
  - Autonomic nervous system

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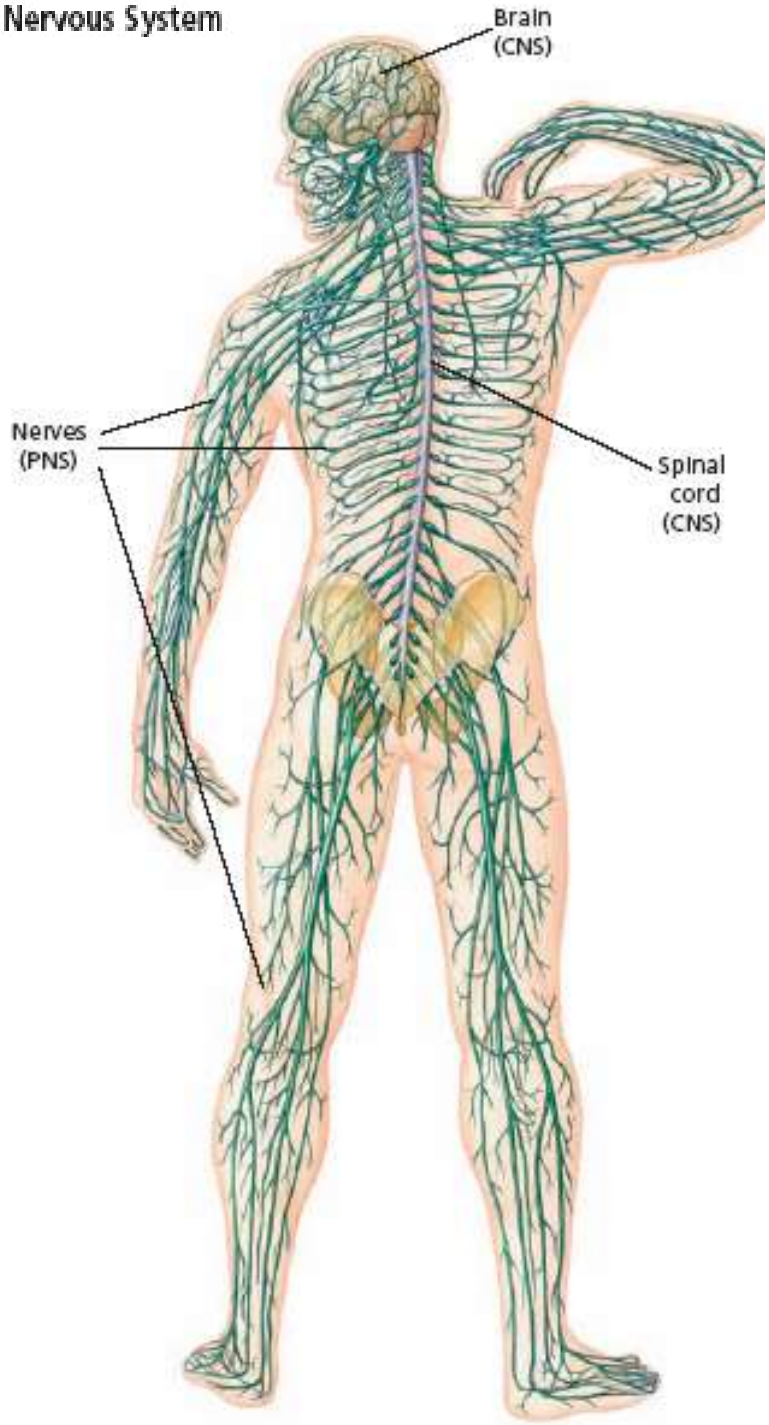
FIGURE 2.7 **The Peripheral Nervous System**



LO 2.6 Somatic nervous system

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Somatic Nervous System

- Soma = body.
- Somatic nervous system - division of the PNS consisting of nerves that carry information from the senses to the CNS and from the CNS to the voluntary muscles of the body.
  - Sensory pathway - nerves coming from the sensory organs to the CNS consisting of sensory neurons.
  - Motor pathway - nerves coming from the CNS to the *voluntary* muscles, consisting of motor neurons.

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Autonomic Nervous System

- Autonomic nervous system (ANS) - division of the PNS consisting of nerves that control all of the *involuntary* muscles, organs, and glands sensory pathway nerves coming from the sensory organs to the CNS consisting of sensory neurons.

  - Sympathetic division (fight-or-flight system) - part of the ANS that is responsible for reacting to stressful events and bodily arousal.
  - Parasympathetic division - part of the ANS that restores the body to normal functioning after arousal and is responsible for the day-to-day functioning of the organs and glands.

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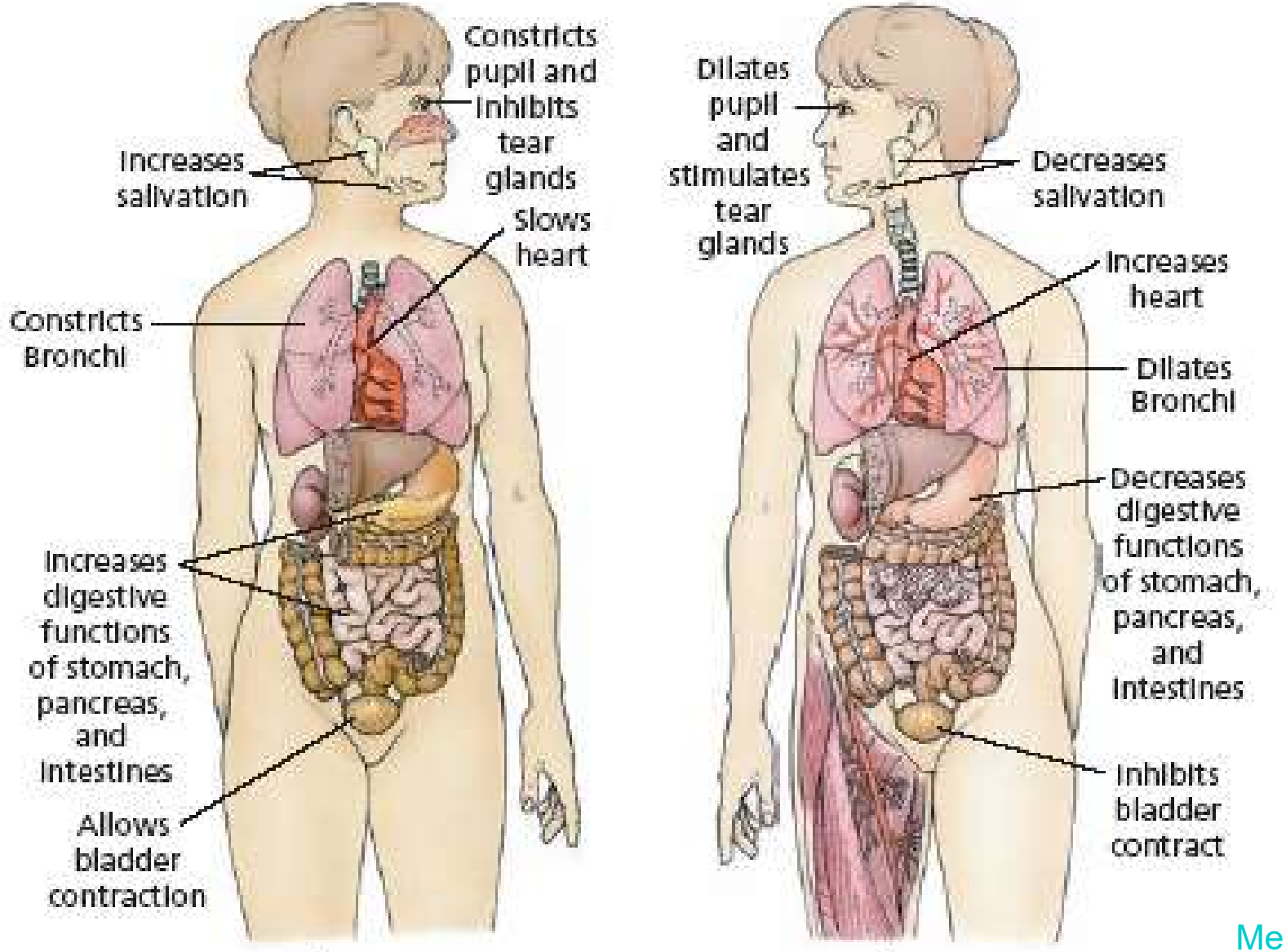
FIGURE 2.8 **Functions of the Parasympathetic and Sympathetic Divisions of the Nervous System**



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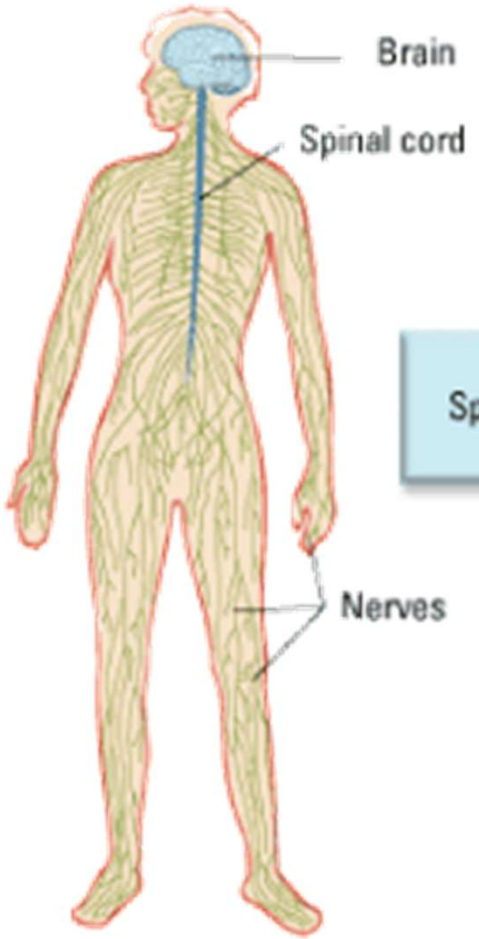
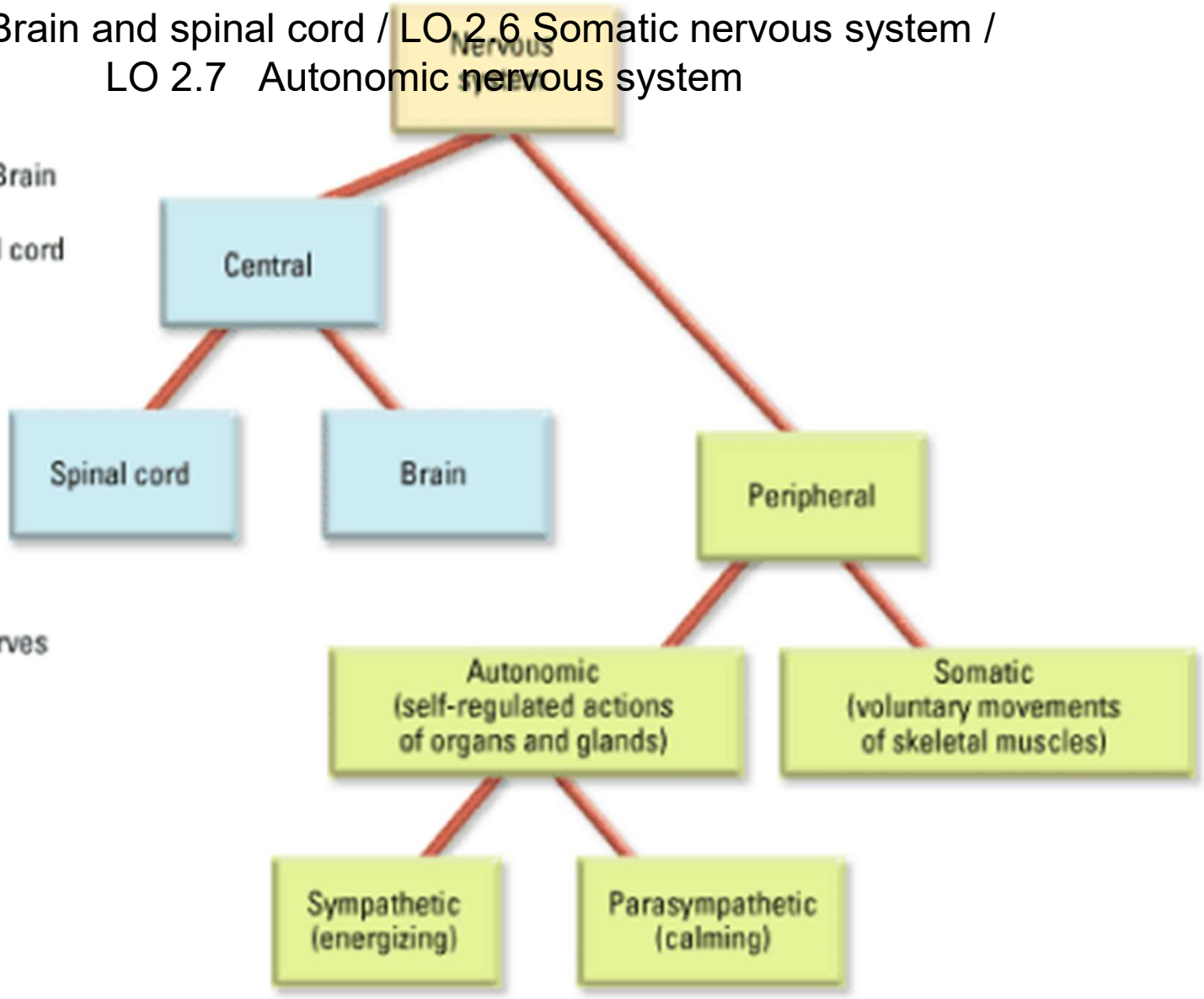
LO 2.5 Brain and spinal cord / LO 2.6 Somatic nervous system / LO 2.7 Autonomic nervous system





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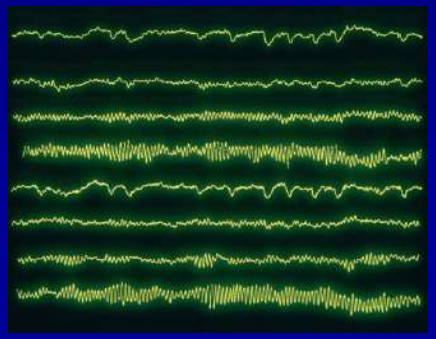
Peeking Inside the Brain

- Clinical studies
  - Deep lesioning - insertion of a thin, insulated wire into the brain through which an electrical current is sent that destroys the brain cells at the tip of the wire.
  - Electrical stimulation of the brain (ESB) – milder electrical current that causes neurons to react as if they had received a message.
  - Human brain damage.
- Electroencephalograph (EEG) - machine designed to record the brain wave patterns produced by electrical activity of the surface of the brain.



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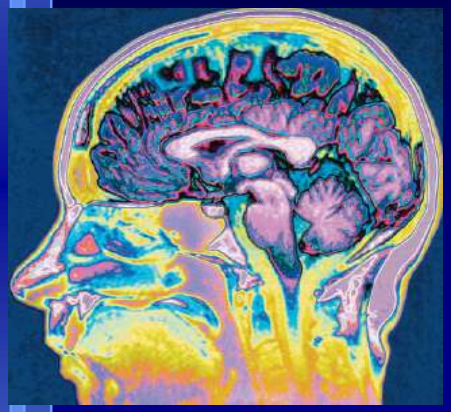
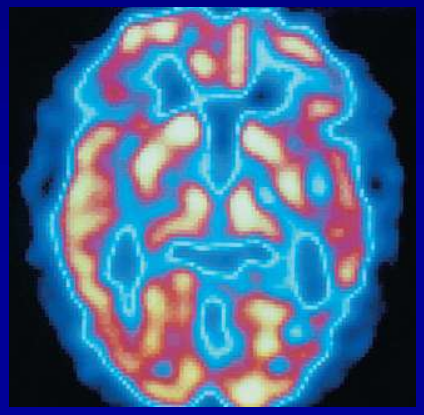
Peeking Inside the Brain

- Computed tomography (CT) - brain-imaging method using computer controlled X-rays of the brain.



- Magnetic resonance imaging (MRI) - brain-imaging method using radio waves and magnetic fields of the body to produce detailed images of the brain.
  - Functional MRI (fMRI) – computer makes a sort of "movie" of changes in the activity of the brain using images from different time periods.

- Positron emission tomography (PET) - brain-imaging method in which a radioactive sugar is injected into the subject and a computer compiles a color-coded image of the activity of the brain with lighter colors indicating more activity.



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The Brain Stem

- Medulla - the first large swelling at the top of the spinal cord, forming the lowest part of the brain, which is responsible for life-sustaining functions such as breathing, swallowing, and heart rate.
- Pons - the larger swelling above the medulla that connects the top of the brain to the bottom and that plays a part in sleep, dreaming, left–right body coordination, and arousal.

Menu

The Brain Stem

- Reticular formation (RF) - an area of neurons running through the middle of the medulla and the pons and slightly beyond that is responsible for selective attention.
- Cerebellum - part of the lower brain located behind the pons that controls and coordinates involuntary, rapid, fine motor movement.

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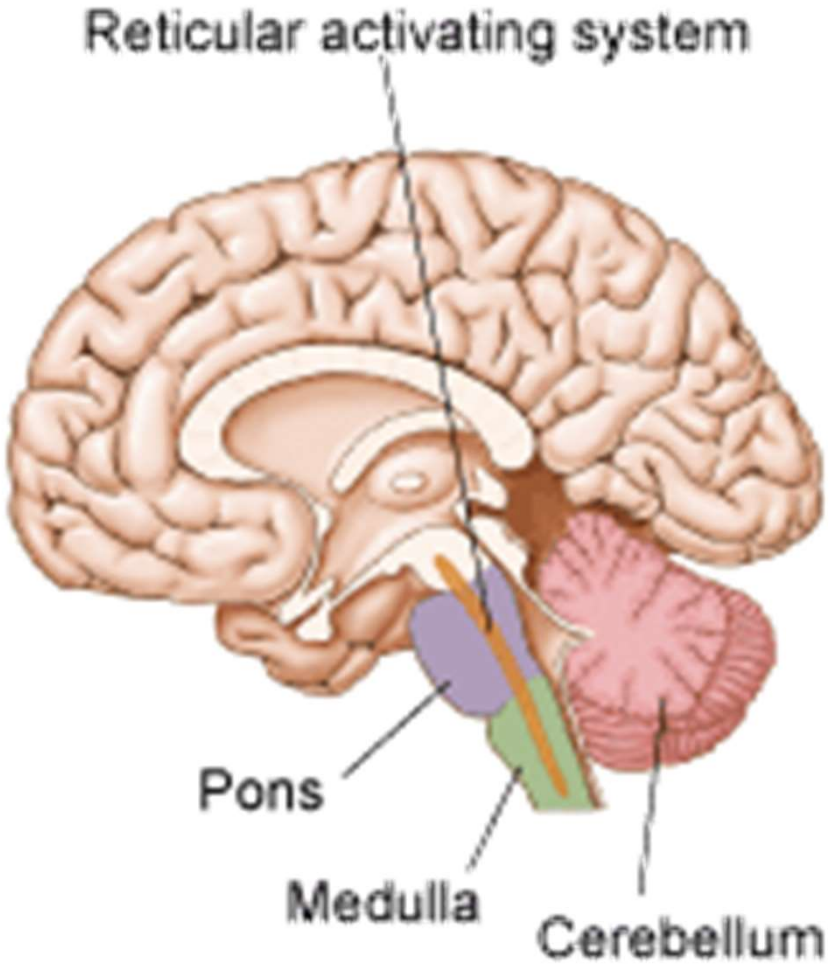
LO 2.9 Structures of the bottom part of brain



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Structures Under the Cortex

- Limbic system - a group of several brain structures located under the cortex and involved in learning, emotion, memory, and motivation.
  - Thalamus - part of the limbic system located in the center of the brain, this structure relays sensory information from the lower part of the brain to the proper areas of the cortex and processes some sensory information before sending it to its proper area.
  - Olfactory bulbs - two projections just under the front of the brain that receive information from the receptors in the nose located just below.

Menu

Structures Under the Cortex

- Limbic system (continued)
  - Hypothalamus - small structure in the brain located below the thalamus and directly above the pituitary gland, responsible for motivational behavior such as sleep, hunger, thirst, and sex.
    - Sits above and controls the pituitary gland (master endocrine gland).
  - Hippocampus - curved structure located within each temporal lobe, responsible for the formation of long-term memories and the storage of memory for location of objects.
  - Amygdala - brain structure located near the hippocampus, responsible for fear responses and memory of fear.

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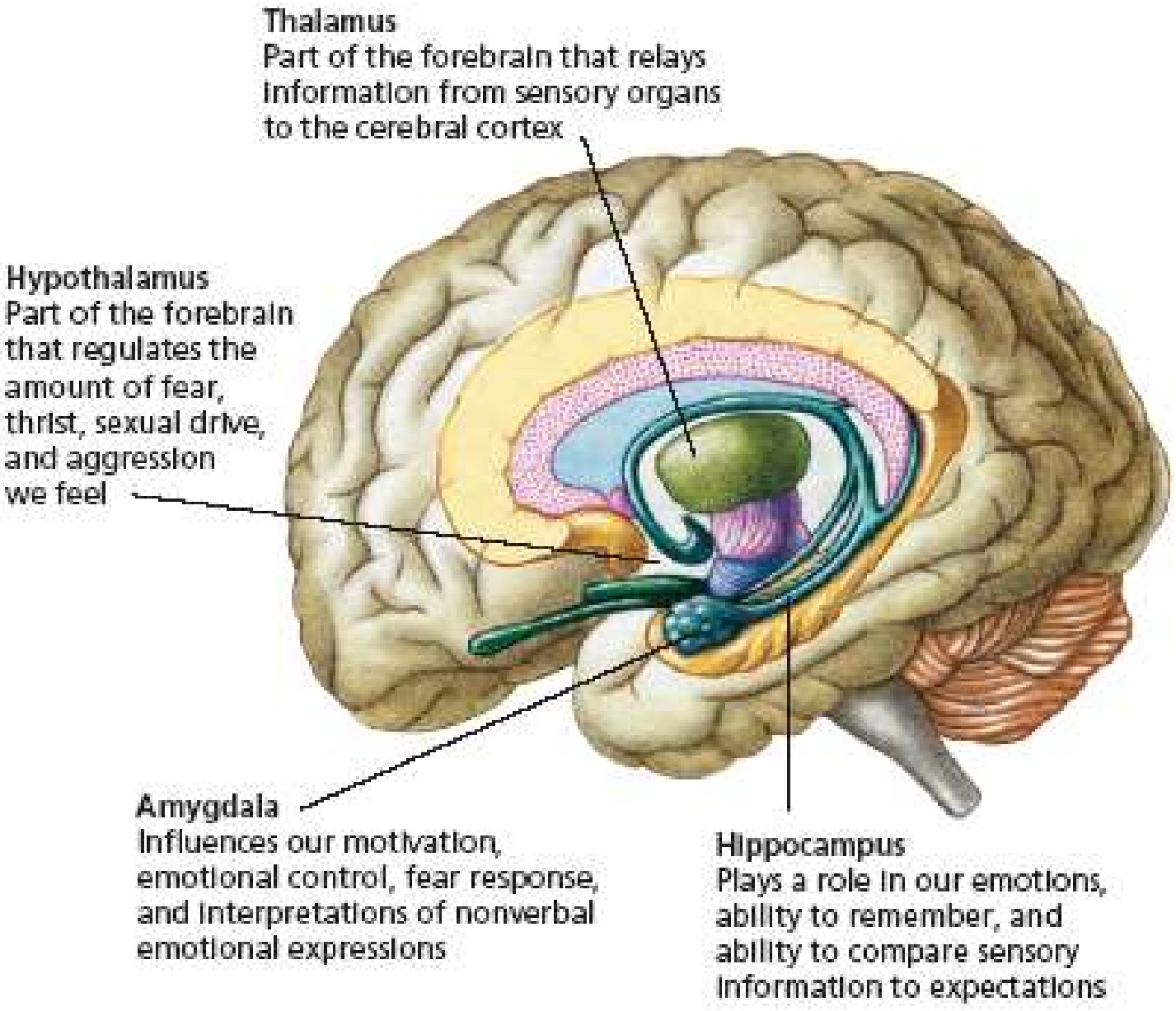
LO 2.10 Structures controlling emotion, learning, memory, and motivation

FIGURE 2.11 **The Limbic System**


Thalamus
Part of the forebrain that relays information from sensory organs to the cerebral cortex
Hypothalamus
Part of the forebrain that regulates the amount of fear, thrist, sexual drive, and aggression we feel
Amygdala
Influences our motivation, emotional control, fear response, and interpretations of nonverbal emotional expressions
Hippocampus
Plays a role in our emotions, ability to remember, and ability to compare sensory information to expectations

Menu

Cortex

- Cortex - outermost covering of the brain consisting of densely packed neurons, responsible for higher thought processes and interpretation of sensory input.
- Corticalization – wrinkling of the cortex.
  - Allows a much larger area of cortical cells to exist in the small space inside the skull.

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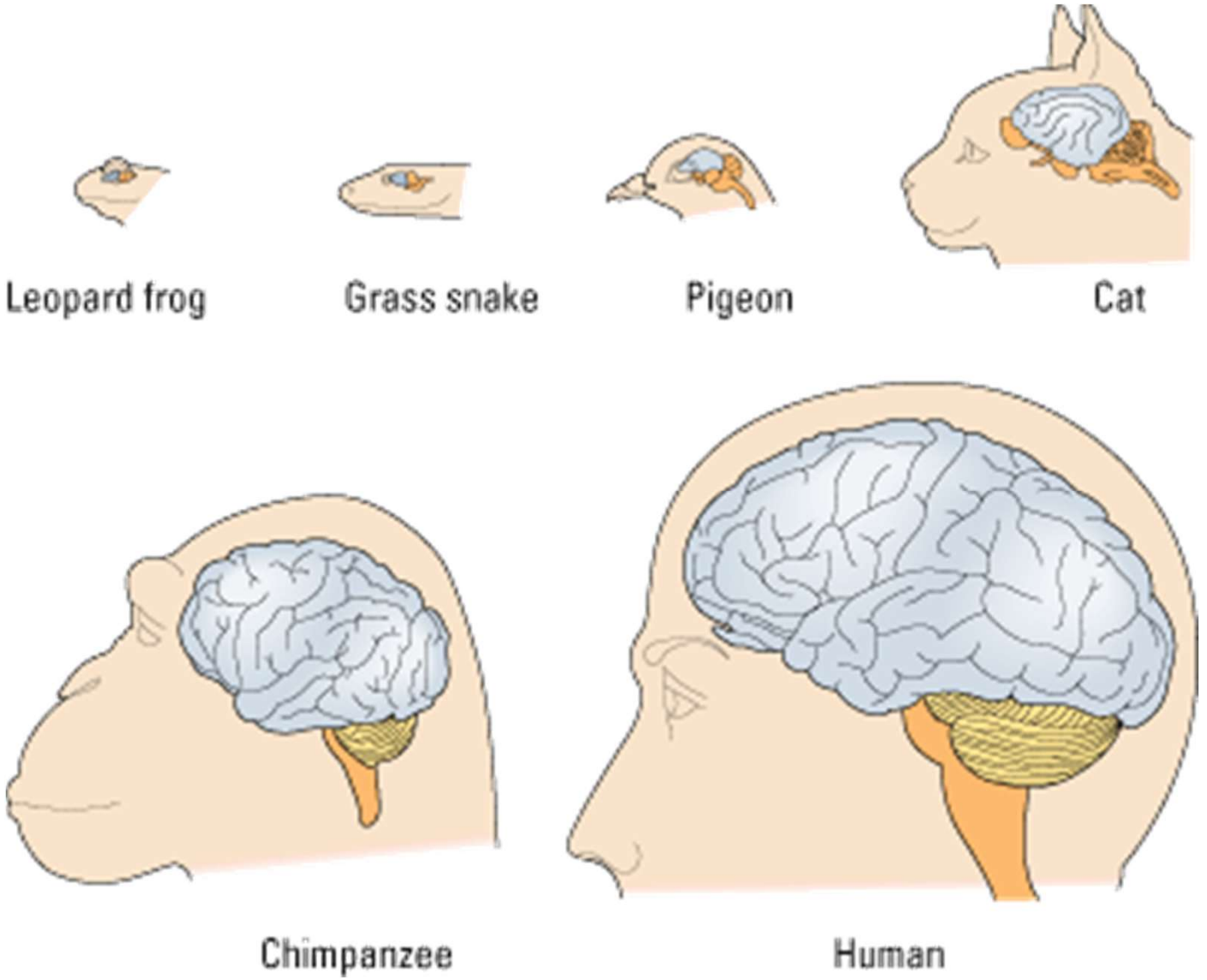
Human cortex compared to various animal species



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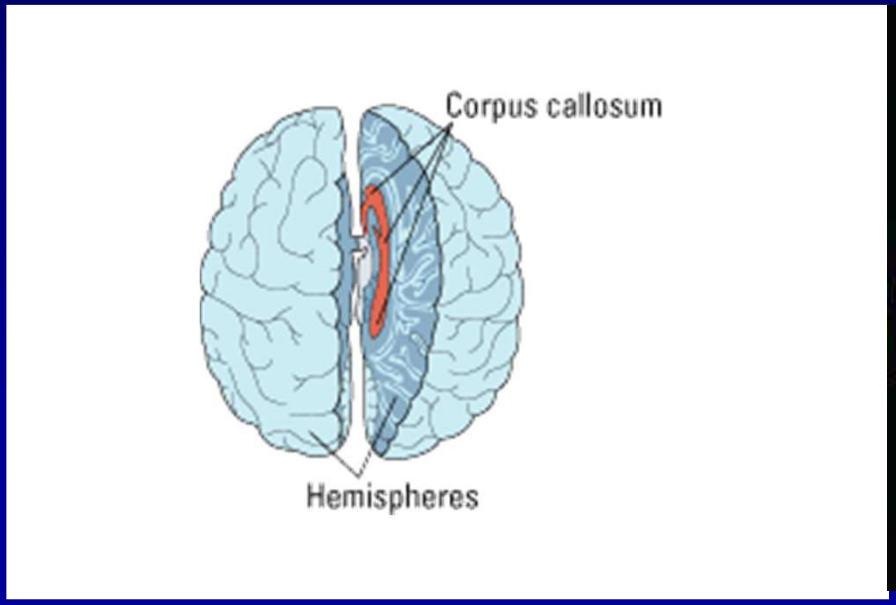
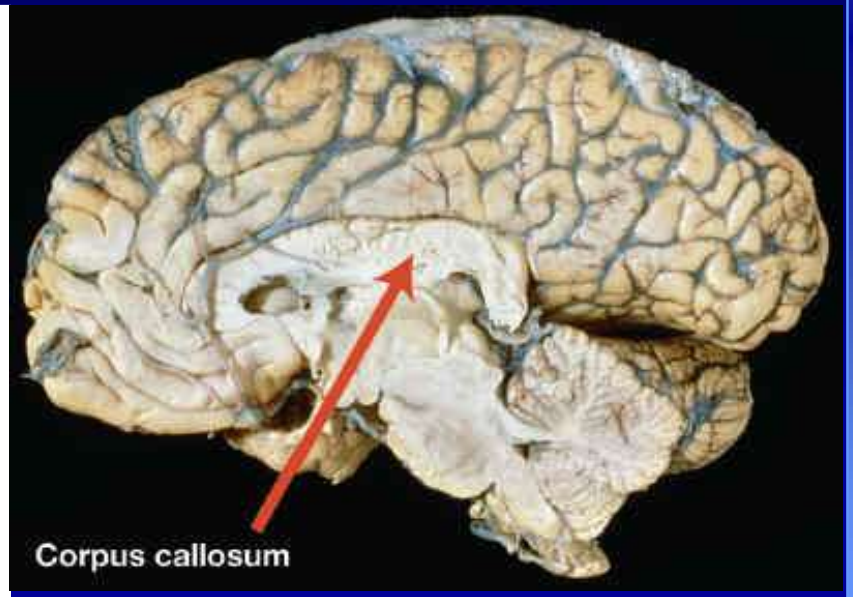
Cerebral Hemispheres

- Cerebral hemispheres - the two sections of the cortex on the left and right sides of the brain.
- Corpus callosum - thick band of neurons that connects the right and left cerebral hemispheres.





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Four Lobes of the Brain

- Occipital lobe - section of the brain located at the rear and bottom of each cerebral hemisphere containing the visual centers of the brain.
  - Primary visual cortex – processes visual information from the eyes.
  - Visual association cortex – identifies and makes sense of visual information.
- Parietal lobes - sections of the brain located at the top and back of each cerebral hemisphere containing the centers for touch, taste, and temperature sensations.
  - Somatosensory cortex - area of neurons running down the front of the parietal lobes responsible for processing information from the skin and internal body receptors for touch, temperature, body position, and possibly taste.

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Four Lobes of the Brain

- Temporal lobes - areas of the cortex located just behind the temples containing the neurons responsible for the sense of hearing and meaningful speech.
  - Primary auditory cortex – processes auditory information from the ears.
  - Auditory association cortex – identifies and makes sense of auditory information.

- Frontal lobes - areas of the cortex located in the front and top of the brain, responsible for higher mental processes and decision making as well as the production of fluent speech.
  - Motor cortex - section of the frontal lobe located at the back, responsible for sending motor commands to the muscles of the somatic nervous system.

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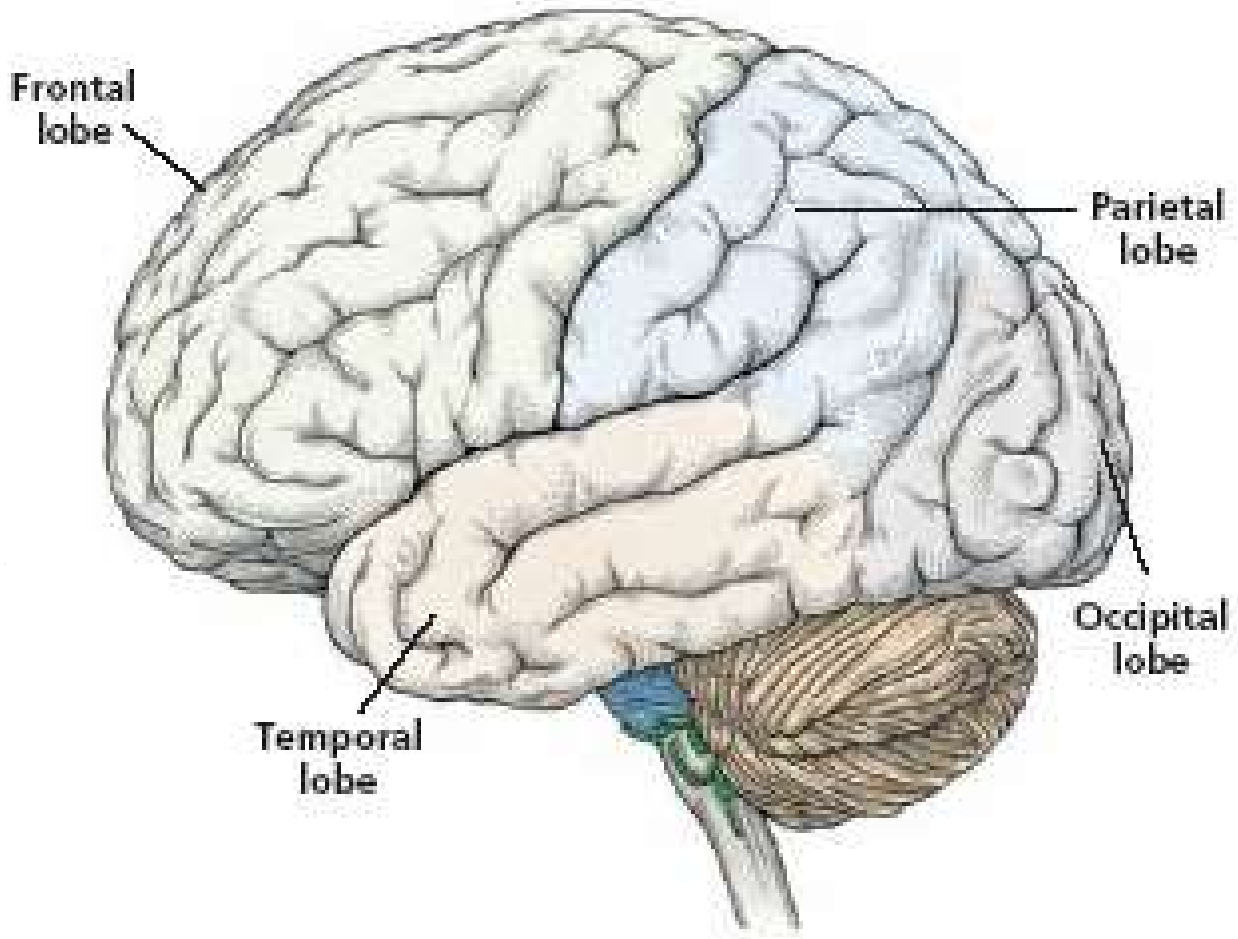
LO 2.11 Parts of cortex controlling senses and movement

FIGURE 2.12 **The Lobes of the Brain: Occipital, Parietal, Temporal, and Frontal**



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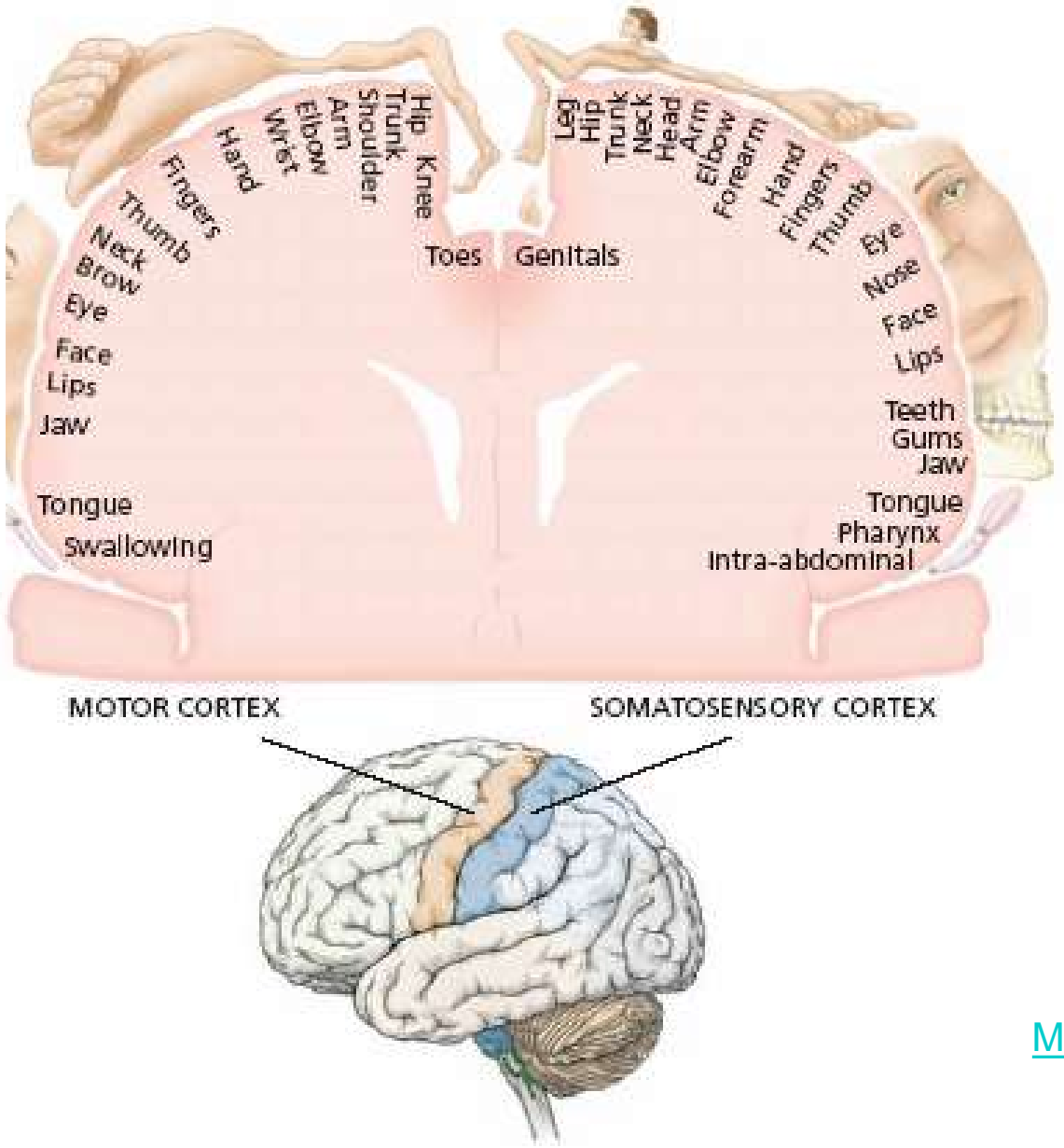
LO 2.11 Parts of cortex controlling senses and movement

FIGURE 2.13 **The Somatosensory and Motor Areas** The motor cortex in the frontal lobe controls the voluntary muscles of the body. Cells at the top of the motor cortex control musdes at the bottom of the body, while cells at the bottom of the motor cortex control muscles at the top of the body. Body parts are drawn larger or smaller according to the number of cortical cells devoted to that body part. For example, the hand has many small muscles and requires a larger area of cortical cells to control it. The somatosensory cortex, located in the parietal lobe just behind the motor cortex, is organized in much the same manner, and receives information about the sense of touch and body position.



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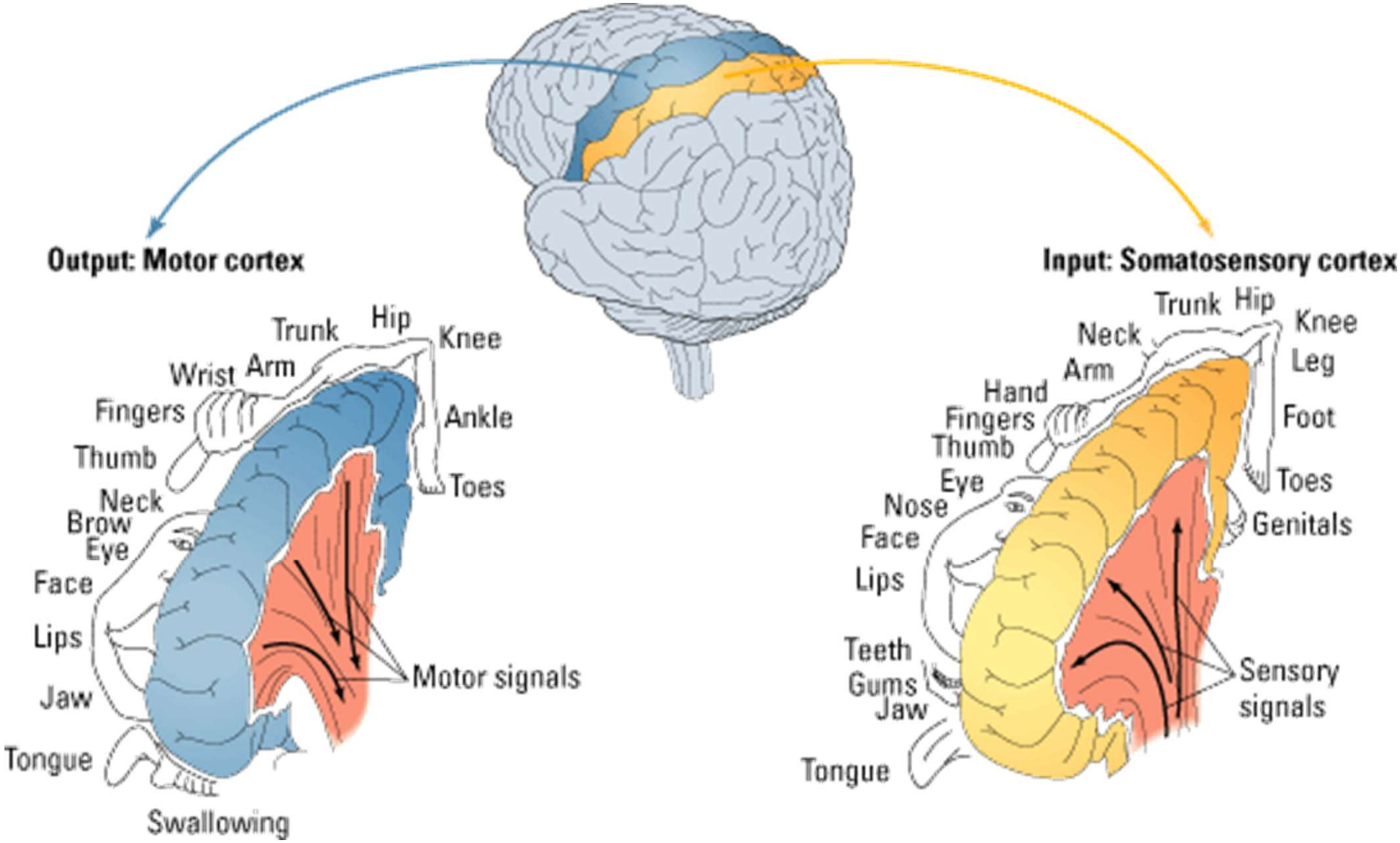
LO 2.11 Parts of cortex controlling senses and movement



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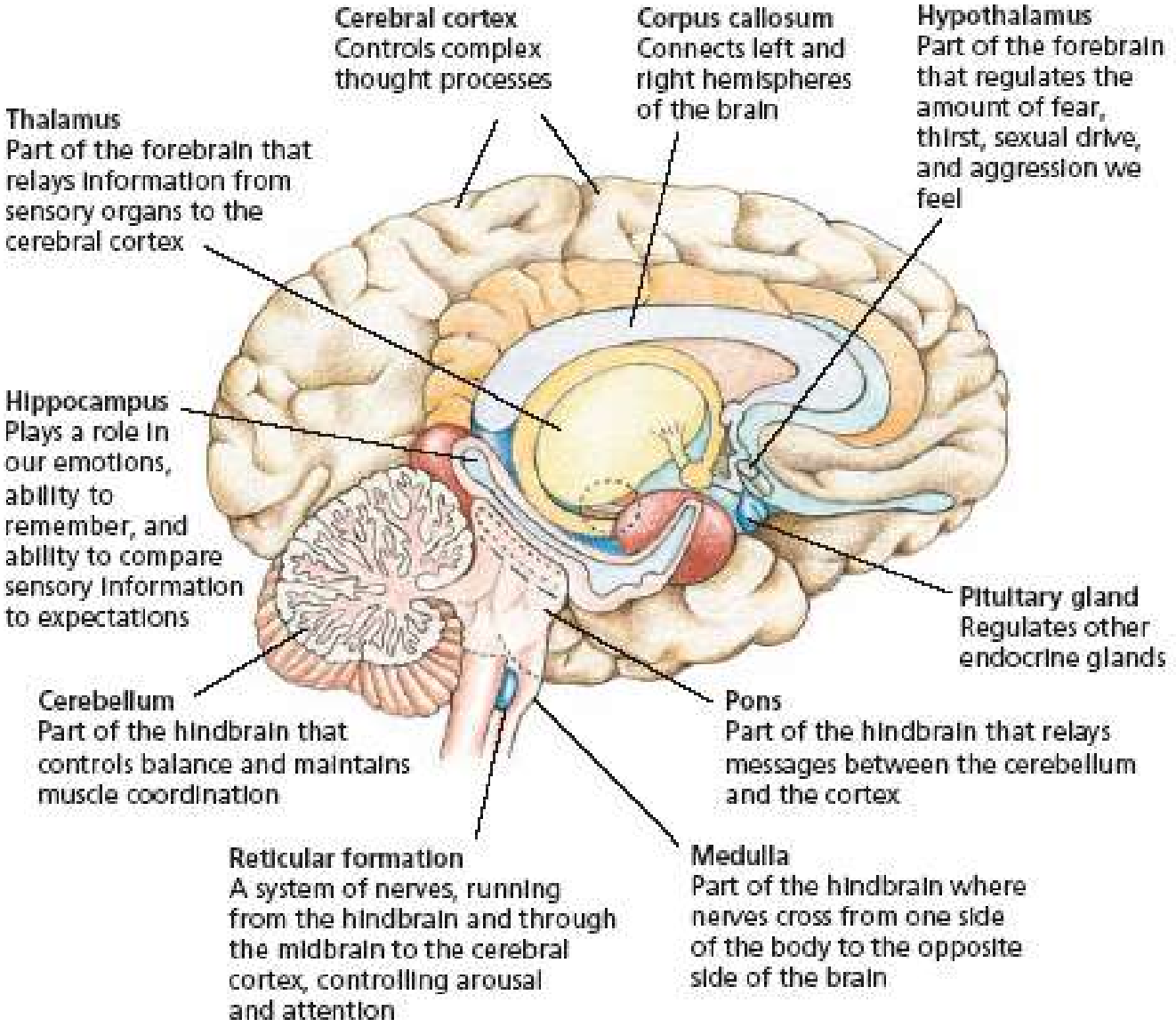
LO 2.9 / 2.10 / 2.11 Major Structures of the Brain

FIGURE 2.10 **The Major Structures of the Human Brain**


Cerebral cortex
Controls complex thought processes
Corpus callosum
Connects left and right hemispheres of the brain
Hypothalamus
Part of the forebrain that regulates the amount of fear, thirst, sexual drive, and aggression we feel
Thalamus
Part of the forebrain that relays information from sensory organs to the cerebral cortex
Hippocampus
Plays a role in our emotions, ability to remember, and ability to compare sensory information to expectations
Pituitary gland
Regulates other endocrine glands
Cerebellum
Part of the hindbrain that controls balance and maintains muscle coordination
Pons
Part of the hindbrain that relays messages between the cerebellum and the cortex
Reticular formation
A system of nerves, running from the hindbrain and through the midbrain to the cerebral cortex, controlling arousal and attention
Medulla
Part of the hindbrain where nerves cross from one side of the body to the opposite side of the brain

Menu

Association Areas of Cortex

- Association areas - areas within each lobe of the cortex responsible for the coordination and interpretation of information, as well as higher mental processing.
- Broca's aphasia - condition resulting from damage to Broca's area (usually in left frontal lobe), causing the affected person to be unable to speak fluently, to mispronounce words, and to speak haltingly.
- Wernicke's aphasia - condition resulting from damage to Wernicke's area (usually in left temporal lobe), causing the affected person to be unable to understand or produce meaningful language.
- Spatial neglect - condition produced by damage to the association areas of the right hemisphere resulting in an inability to recognize objects or body parts in the left visual field.

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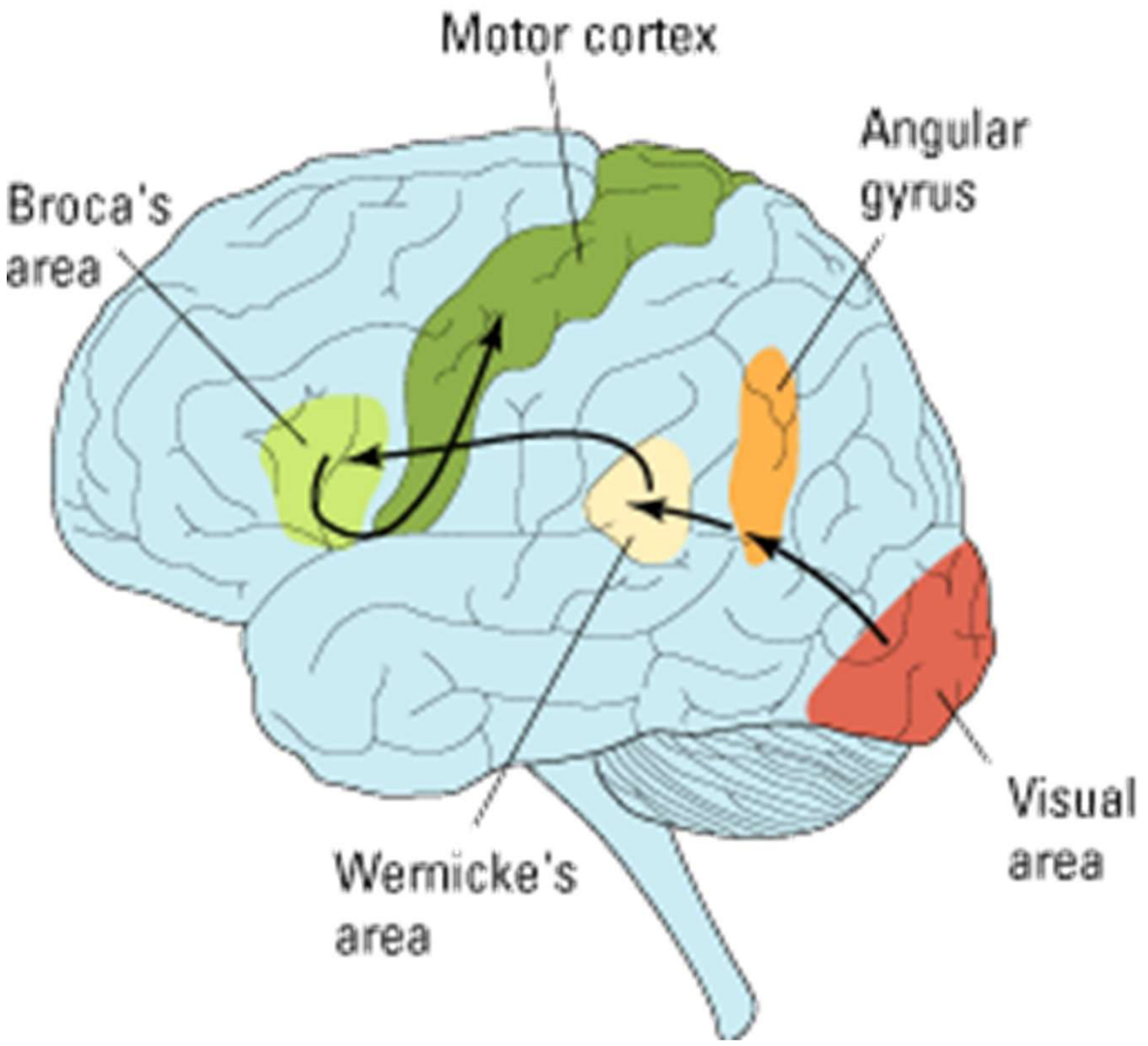
LO 2.12 Parts of cortex responsible for higher thought



Menu

Spatial neglect

Menu

Split Brain Research

- Cerebrum - the upper part of the brain consisting of the two hemispheres and the structures that connect them.
- Split brain research
  - Study of patients with severed corpus callosum.
  - Involves sending messages to only one side of the brain.
  - Demonstrates right and left brain specialization.

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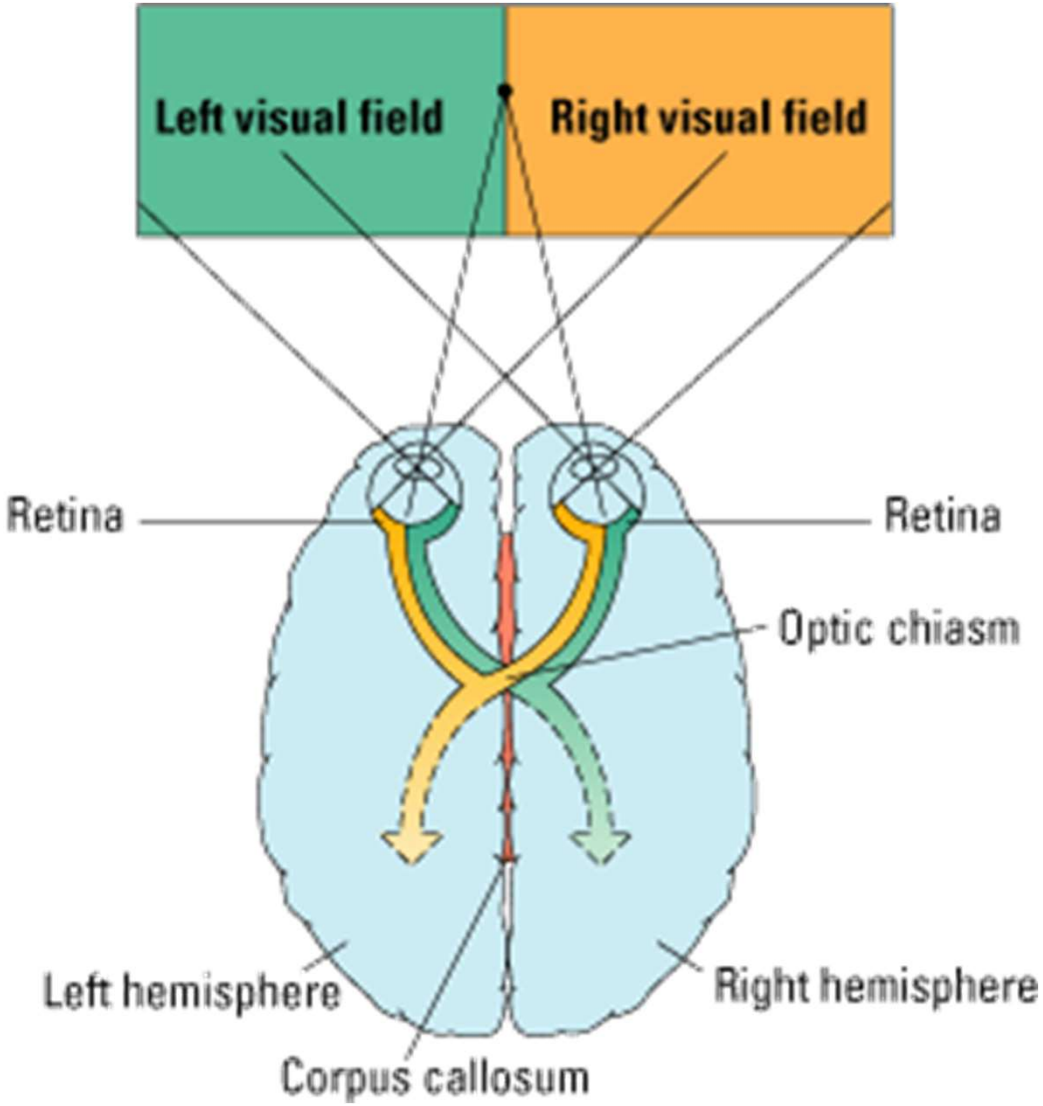
LO 2.13 Left side and right side of brain



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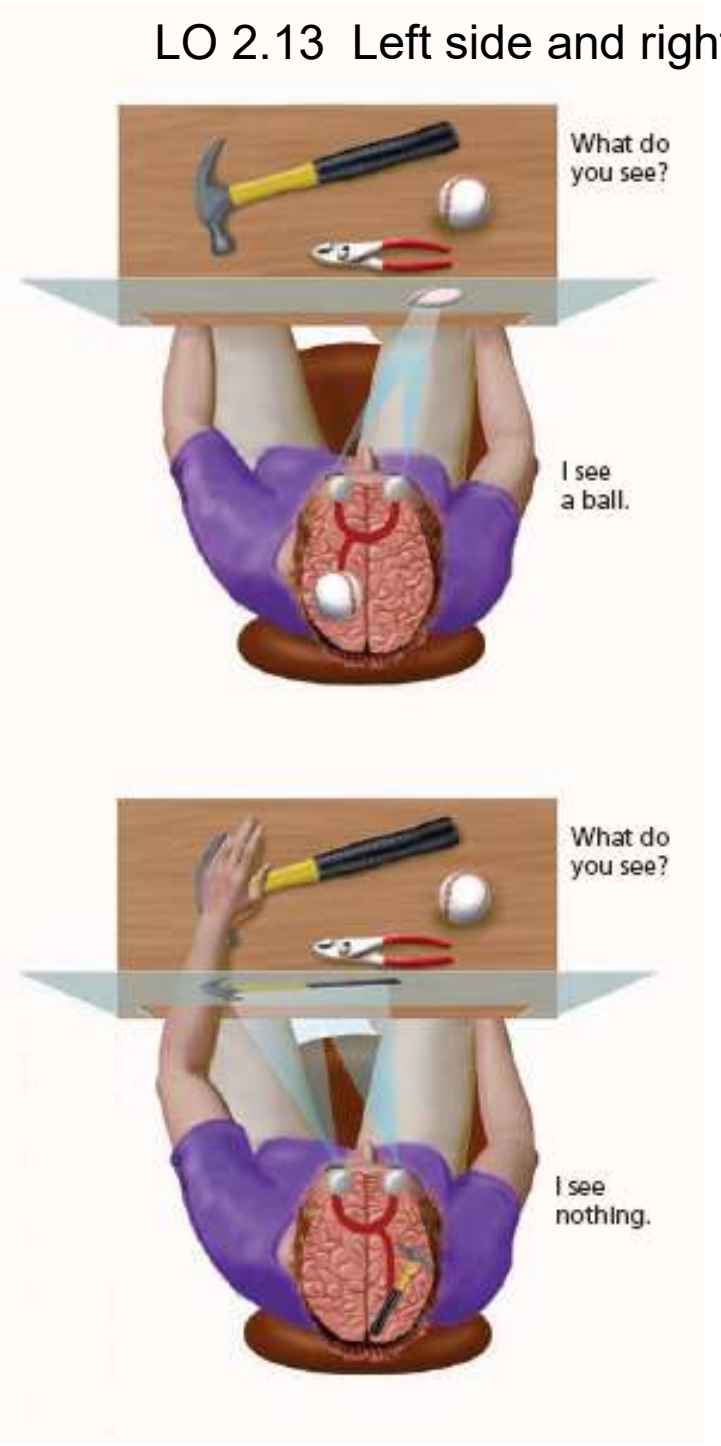
LO 2.13 Left side and right side of brain

FIGURE 2.14 **The Split-Brain Experiment** Roger Sperry created this experiment to demonstrate the specialization of the left and right hemispheres of the brain.



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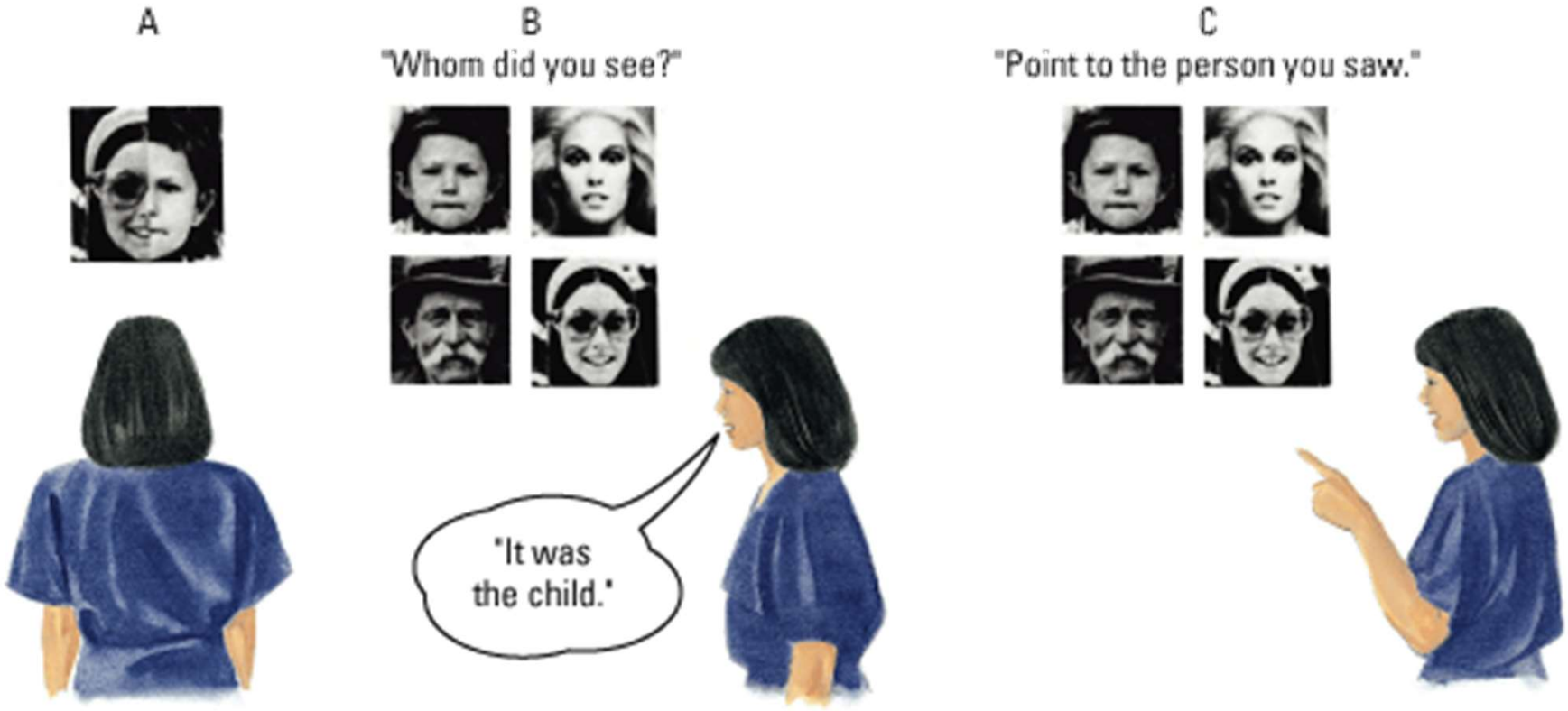
LO 2.13 Left side and right side of brain



Split-brain subjects stared at a dot and viewed a composite of two faces (A). When asked what they saw, subjects chose the child—the image sent to the verbal left hemisphere (B). But when subjects pointed to the face with the left hand, they chose the woman with glasses—whose image was received by the right hemisphere (C) (Levy et al., 1983).

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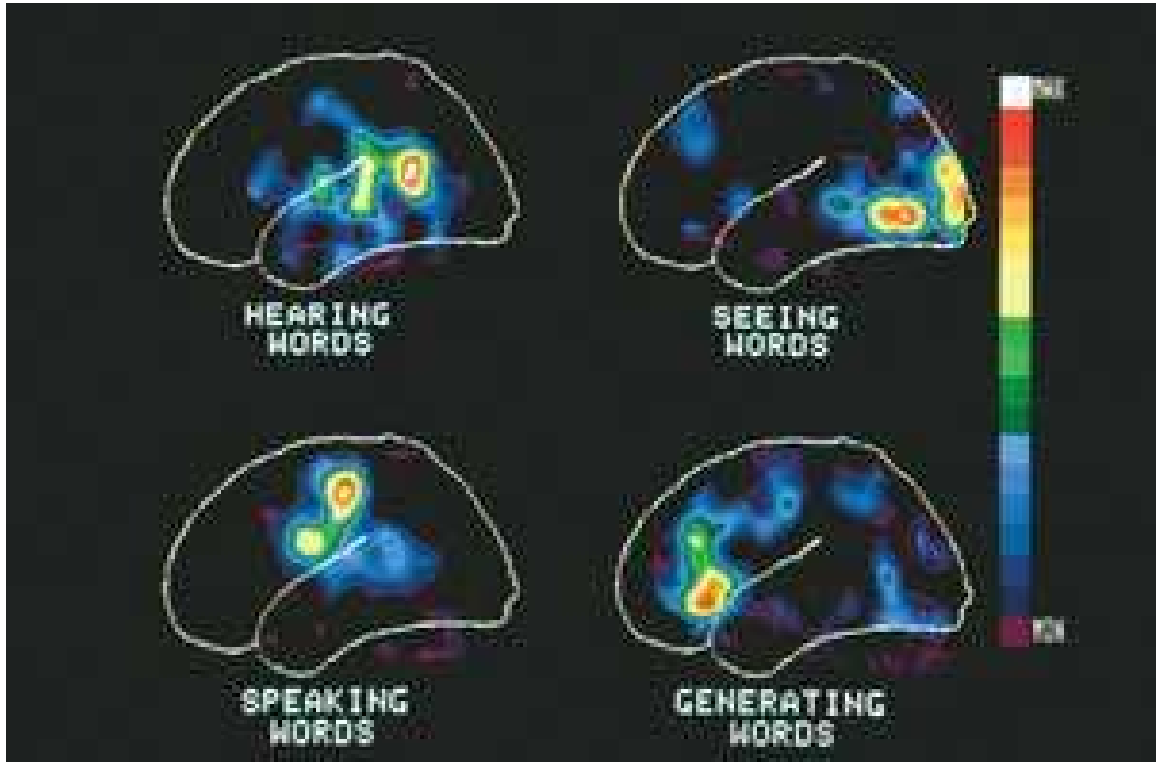
Language is primarily a left hemisphere activity for most individuals



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Results of Split Brain Research

- Left side of the brain:
  - seems to control language, writing, logical thought, analysis, and mathematical abilities,
  - processes information sequentially,
  - can speak.
- Right side of the brain
  - controls emotional expression, spatial perception, recognition of faces, patterns, melodies, and emotions,
  - processes information globally,
  - cannot speak.

Menu

The Endocrine Glands

- Endocrine glands - glands that secrete chemicals called hormones *directly* into the bloodstream.
  - Hormones - chemicals released into the bloodstream by endocrine glands.
- Pituitary gland - gland located in the brain that secretes human growth hormone and influences all other hormone-secreting glands (also known as the master gland).
- Pineal gland - endocrine gland located near the base of the cerebrum that secretes melatonin.
- Thyroid gland - endocrine gland found in the neck that regulates metabolism.
- Pancreas - endocrine gland that controls the levels of sugar in the blood.

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The Endocrine Glands

- Gonads - the sex glands that secrete hormones that regulate sexual development and behavior as well as reproduction.
  - Ovaries - the female gonads.
  - Testes - the male gonads.
- Adrenal glands - endocrine glands located on top of each kidney that secrete over 30 different hormones to deal with stress, regulate salt intake, and provide a secondary source of sex hormones affecting the sexual changes that occur during adolescence.

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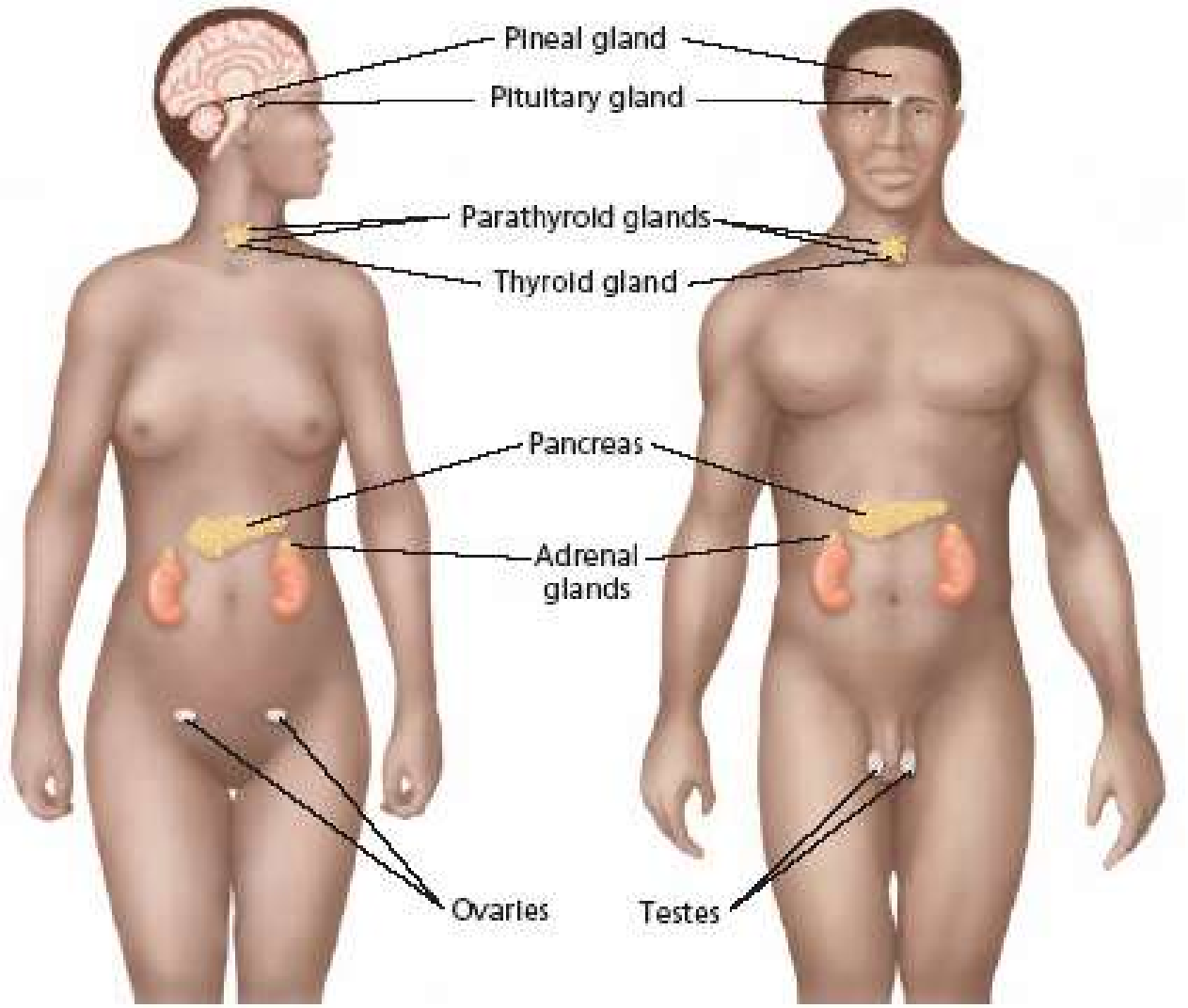
LO 2.14 Hormones and nervous system

FIGURE 2.15 **The Endocrine Glands** The endocrine glands secrete hormones directly into the bloodstream, which carries them to organs in the body, such as the heart, pancreas, and sex organs.



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Web Resources

Amazing Case of Phineas Gage: http://www.epub.org.br/cm/n02/historia/phineas.htm

Account by Renato M. E. Sabbatini, Ph.D., published in the online journal, *Brain and Mind*.

Amen Clinics Atlas: http://amenclinics.com/bp/atlas/

You might want to check out for some more information on the brain along with some CAT scans and MRI's and PET's. This is a great website sponsored by Amen Clinics Inc., A Medical Corporation.

Autonomic Nervous System: http://faculty.washington.edu/chudler/auto.html

Succinct summary of information about the structure and function of the autonomic nervous system, prepared by Eric Chudler.

Basic Neural Processes Tutorials: http://psych.hanover.edu/Krantz/neurotut.html

A good site for your students to help them learn about basic brain functioning.

Biological and Physiological Resources: http://psych.athabascau.ca/html/aupr/biological.shtml

Links to several sites and interesting topical articles relevant to biological and physiological psychology. A good starting point for a number of assignments, such as writing short papers or assembling study guide terms. Maintained by the Centre for Psychology Resources at Athabasca University, Alberta, Canada.

Biological Psychology: http://www.csuchico.edu/psy/BioPsych/definition.html

Information about the field from the biological psychologists at California State University, Chico.

Brain and Behavior : http://serendip.brynmawr.edu/bb/

This mega-site contains lots of links to information about the brain, behavior, and the bond between the two. Students can complete several interactive exercises to learn more about brain functions.

***Brain & Mind* – Electronic Magazine on Neuroscience** http://www.epub.org.br/cm/

MUST SEE SITE!!! Includes a wealth of short articles devoted to the brain.

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Web Resources

Brain Briefings - Society for Neuroscience:
http://www.sfn.org/content/Publications/BrainBriefings/index.html

A series of 2-page reports that describe clinical applications of basic neuroscience research. Includes reports in the following areas: Brain Injury, Brain Mechanisms, Development, Drugs, Eating, Emotions, Exercise, Gender, Memory, Nervous System Disorders and Diseases, Nervous System Repair, Pain, The Senses, Sleep, and Technology.

Brain Connection: The Brain and Learning: http://www.brainconnection.com/

A newspaper-style web page that contains interesting articles, news reports, activities, and commentary on brain-related issues.

Brain Function and Pathology: http://www.waiting.com/brainfunction.html

Concise table of diagrams of brain structures, descriptions of brain functions, and descriptions of signs and symptoms associated with brain structures and functions.

Brain Model Tutorial: http://pegasus.cc.ucf.edu/~Brainmd1/brain.html

This tutorial teaches students about the various parts of the human brain and allows them to test their knowledge of brain structures.

Brain Reorganization:
http://www.sfn.org/content/Publications/BrainBriefings/brain_reorg.html

Brief information on how the brain changes with experience, prepared by the Society for Neuroscience.

Brain: Right Down the Middle: http://faculty.washington.edu/chudler/sagittal.html

Useful drawing and succinct information about the location and functions of brain structures that can be seen on the midsagittal plane, presented by Eric Chudler.

Menu

Web Resources

Central Nervous System -- CliniWeb International:
http://www.ohsu.edu/cliniweb/A8/A8.186.html

Lots and lots of links to information about the central nervous system. See MRI images, link to research labs, and learn about the brain and spinal cord.

Comprehensive Behavioral and Cognitive Sciences:
http://mentalhelp.net/guide/pro02.htm

Includes theory and therapy. This site includes web links with descriptions and ratings of each source. Useful for spicing up your lectures or for more detailed study by your students.

***Conversations with Neil's Brain* (1994):**
http://faculty.washington.edu/wcalvin/bk7/bk7.htm

An Online Book by William H. Calvin & George A. Ojemann of University of Washington. Teachers are allowed to print and photocopy chapters for educational use.

Cross Sections of the Human Brain: http://www.neuropat.dote.hu/caud.gif

A cross-sectional image of the human brain. Good to have on hand if you need one. Show your students and help them identify the various structures.

Dogma Overturned: http://www.sciam.com/1998/1198issue/1198infocus.html

Upending a long-held theory, a study finds that humans can grow new brain neurons throughout life. This research summary was published in Scientific American.

Drugs, Brains, and Behavior: http://www.rci.rutgers.edu/~lwh/drugs/

An online textbook detailing the effects of various substances on the brain, authored by C. Robin Timmons & Leonard W. Hamilton.

Harvard Brain: http://www.hcs.harvard.edu/~husn/BRAIN/index.html

The brains behind Harvard University? No, just a journal published by the Harvard Undergraduate Society for Neuroscience.

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Web Resources

History of Phrenology: http://pages.britishlibrary.net/phrenology/

Follow the bumpy road to discovering phrenology's past from a professor of history at the University of Cambridge.

How do Nerve Cells Communicate?
http://www.sfn.org/content/Publications/BrainBackgrounders/communication.htm

Information prepared by the Society for Neuroscience.

The Human Brain: A Learning Tool: http://uta.maymt.edu/~psychol/brain.html

These close-up pictures of the brain's lobes can be added to your classroom presentations. Link to this site, turn on your classroom's media projector, and let the action begin.

Human Corpus Callosum: http://www.indiana.edu/~pietsch/callosum.html

Information and links about the corpus callosum and "split-brain surgery" by Paul Pietsch.

Lobes of the Brain : http://faculty.washington.edu/chudler/lobe.html

Succinct information about the location and functions of the four lobes of the cerebrum, presented by Eric Chudler. Includes link to "Lobes of the Brain Review," a very brief quiz on functions associated with major lobes of the brain. Answers provided online: http://faculty.washington.edu/chudler/revlobe.html

Localization of Function Exercise:
http://www.gpc.peachnet.edu/~bbrown/psyc1501/brain/locfunct.htm

Allows students to simulate the effects of stimulating the brain, recording electrical activity from the brain, or creating lesions in the brain, then to try to figure out the functions of various parts of the brain based on the data they have collected. Developed by Dr. Barbara Brown of Georgia Perimeter College.

Menu

Web Resources

Making Connections – The Synapse: http://faculty.washington.edu/chudler/synapse.html

Clear, comprehensible, explanation of how synapses work, with nice illustrations, prepared by Eric Chudler.

Mapping the Brain: http://www.epub.org.br/cm/n03/tecnologia/eeg.htm

Article on the use of various methods of recording brain activity to map the location of functional areas of the brain, by Renato Sabbatini, Ph.D. Published in the online journal, *Brain & Mind*.

Neural Processes Tutorial: http://psych.hanover.edu/Krantz/neurotut.html

An excellent interactive animated tutorial.

Neuroguide.com – Neurosciences on the Internet: http://www.neuroguide.com/

A resource for all things related to neuroscience: databases, diseases, research centers, software, biology, psychology, journals, tutorials, and so much more.

Neuropsychology Central: http://www.neuropsychologycentral.com/

Links to resources related to neuropsychology, including brain images, and extensive, well-organized, links to other sites.

Neuroscience for Kids: http://faculty.washington.edu/chudler/neurok.html

Don't be put off by the name! This site can be enjoyed by people of all ages who want to learn about the brain. Fun, superbly organized site providing information and links to other neuroscience sites. Includes informative pages regarding Brain Basics, Higher Functions, Spinal Cord, Peripheral Nervous System, The Neuron, Sensory Systems, Methods and Techniques, Drug Effects, and Neurological and Mental Disorders. Even includes a nice answer to the perennial question "Is it true that we only use 10% of our brain?" http://faculty.washington.edu/chudler/tenper.html

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Web Resources

NPAC/OLDA Visible Human Viewer:
http://www.dhpc.adelaide.edu.au/projects/vishuman2/VisibleHuman.html

A little tricky to use, but by following the instructions on this page you can view images of the brain in one of several planes. Currently, only photos are available, but these are quite nice. MRI and CT scans in the same planes are planned for the future.

One Brain…or Two?: http://faculty.washington.edu/chudler/split.html

Information on lateralization of function and how the functions of the hemispheres may be studied, presented by Eric Chudler.

PET Scan: A New Window Into the Brain: http://www.epub.org.br/cm/n01/pet/pet.htm

Article on uses of PET scan to study brain function, by Renato Sabbatini, Ph.D. Published in the online journal, *Brain and Mind*.

Phineas Gage Information Page: http://www.deakin.edu.au/hbs/GAGEPAGE

Everything you ever wanted to know about Phineas Gage on this page prepared by Malcolm Macmillan at Deakin University, Victoria, Australia.

Self-Quiz for Chapter on the Human Nervous System:
http://www.psychwww.com/selfquiz/ch02mcq.htm

Self-quiz prepared by Russ Dewey at Georgia Southern University. Covers material typically found in an introductory psychology textbook chapter with a title like "Brain and Behavior" or "Neuropsychology."

She Brains / He Brains

http://faculty.washington.edu/chudler/heshe.html: Nice summary of evidence for sex-related differences in brain structure, prepared by Eric Chudler.

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Web Resources

Split Brain Consciousness:
http://www.macalester.edu/~psych/whathap/UBNRP/Split_Brain/Split_Brain_Consciousness.html

Nice summary of information on the effects of cutting the corpus callosum, with links to further information on split brain experiments and hemispheric specialization.

Synapses: http://www.gpc.peachnet.edu/~bbrown/psyc1501/brain/synapses.htm

Contains basic information about synapses and an animation of neurotransmitter release and binding to receptors at a synapse.

Theories on the Role of Brain Structures in the Formation of Emotions:
http://www.epub.org.br/cm/n05/mente/teorias_i.htm

Nice diagrams of the limbic system are included in this article by Júlio Rocha de Amaral, MD & Jorge Martins de Oliveira, MD, PhD, published in the online journal, *Brain & Mind*.

Views of the Brain: http://rpiwww.mdacc.tmc.edu:80/se/anatomy/brain/

Gross anatomical photographs of left, right, anterior, superior, and inferior views of the brain.

What Does Handedness Have to Do with Brain Lateralization (and Who Cares?):
http://www.indiana.edu/~primate/brain.html

Very nice page on lateralization of function in the brain.

What Happened to Phineas?:
http://www2.mc.maricopa.edu/anthro/origins/phineas.html

The story of Phineas Gage, as told by James Shreve.

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Web Resources

What is Mind?: http://www.epub.org.br/cm/n04/editori4_i.htm

Article about the relationship between mind and brain, by Silvia Helena Cardoso, Ph.D. Published in the online journal, *Brain and Mind*.

What is the Cerebellum? http://www.sfn.org/content/Publications/BrainBackgrounders/cerebellum.htm

Information about the structure and function of the cerebellum, prepared by the Society for Neuroscience.

Whole Brain Atlas: http://www.med.harvard.edu:80/AANLIB/home.html

Prepared by Keith Johnson, M.D. and J. Alex Becker at Harvard University. Site includes brain images, information about imaging techniques, and information about specific brain disorders.

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